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GRISON (P.) & ROEHRICH (R.). **Bilans nutritifs chez le doryphore adulte. (Note préliminaire.)**—*Bull. Soc. ent. Fr.* **51** no. 9 pp. 133–137, 14 refs. Paris, 1947.

In laboratory experiments in France to ascertain the quantity of food assimilated by adults of *Leptinotarsa decemlineata*, Say, beetles that had not fed for 24 hours were placed in hermetically sealed weighing-bottles with fresh potato foliage (having a moisture content of 90 per cent.) and kept at a constant temperature of 25°C. [77°F.] for a further 24 hours, after which they were kept without food for six hours until digestion was complete. The results, typical examples of which are given, showed that females tested three days after emergence, just before the diapause and eight days after it, consumed amounts of food equal to 112, 64 and 35 per cent. of their initial weights, respectively; the corresponding figures for males were 104, 25 and 48 per cent. For equal quantities of food consumed, more dry matter was retained by immature beetles than by those taken after the diapause, and slightly more by males than by females. After diapause and hibernation, it was principally the water that was retained.

ENGEL (H.). **Zwei heimische Dipteren als Parasiten des Kartoffelkäfers.** [Two indigenous Diptera as Parasites of the Potato Beetle.]—*Arb. physiol. angew. Ent. Berl.* **10** no. 1 p. 69, 4 refs. Berlin, 1943.

BOCZKOWSKA (M.). **Quelques observations sur *Megaselia rufipes* Meig. et ses rapports avec le doryphore (*Leptinotarsa decemlineata* Say).**—*Bull. Soc. linn. Lyon* 1947 no. 1 pp. 4–5, 5 refs. Lyons, 1947.

It is stated in the first of these papers that *Muscina stabulans*, Fall., and *Megaselia rufipes*, Mg., were reared in Alsace in 1942 from third- and fourth-instar larvae of the potato beetle [*Leptinotarsa decemlineata*, Say] that were collected in the field, kept in glass dishes and fed daily. *Muscina* was bred from larvae collected on 3rd July in a field of potatoes that had been treated with calcium arsenate, and puparia and adults were observed on 10th and 29th July, respectively, while *Megaselia* was reared from apparently healthy larvae collected on 25th July, puparia appearing on 1st–5th August. They are not thought to be of any great importance, since they are only occasionally parasitic and then chiefly attack unhealthy insects. None was obtained from about 10,000 larvae collected in August.

The author of the second paper states that high mortality of newly-emerged adults of *L. decemlineata* was observed at St-Genis-Laval (Rhône) in July 1943, and that larvae of *Megaselia rufipes* were obtained from cavities in the bodies of dead beetles. Young larvae that had consumed the contents of a beetle completed their development on other dead beetles. Pupation occurred in the soil or, in the laboratory, in glass tubes. Adults appeared in the field in late July and August and in October, corresponding to the two generations of *L. decemlineata*. The fact that nearly full-fed larvae of *M. rufipes* were obtained from beetles that had only just died is thought to indicate that they had developed in the living insects, and, in view of Engel's discovery of parasitised larvae, parasitism probably occurred before the beetle larvae entered the soil. During a test carried out in 1944, larvae of *M. rufipes* were obtained from adults of *L. decemlineata* that had emerged in sterilised soil, which showed that the parasites do not enter the host from the soil. It is concluded from these observations and from the literature that *M. rufipes* is an occasional parasite of living and dead adults of *Leptinotarsa*, and that, since the larvae are known to feed on pine seeds [*cf. R.A.E.*, A **16** 236], its abundance at St-Genis-Laval may have been due to the presence of coniferous trees in the immediate neighbourhood.

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BJORNSETH (E. H.). **One Year's Results from dusting Snap Beans to control Anthracnose and Leaf Hoppers.**—*Quart. Bull. Mich. agric. Exp. Sta.* **28** no. 3 pp. 191–193. East Lansing, Mich., 1946.

Snap beans in Michigan are infested by leafhoppers that migrate to them from hayfields when these are mown in early summer and, if abundant, cause flagging or rolling of the leaves. In 1945, beans planted on 27th May were treated four times at weekly intervals with dust containing 3 per cent. DDT, applied at the rate of 25–30 lb. per acre. The first application was made on 27th June and the last one after the first picking. The season was favourable for the crop, but the leafhopper population was heavy. The total yield from the treated plot was 223·45 bushels per acre, as compared with 156·8 from the untreated control, and the plants in the former were more vigorous and free from leaf-rolling. The DDT residues on the beans were not measured, but it is considered that they would not exceed the legal tolerance if the third application were made a week before the first picking and the fourth immediately after it. The dust used for the third and fourth applications also contained 10 per cent. Fermate [ferric dimethyl dithiocarbamate] to control anthracnose, a fungous disease very prevalent in Michigan, but conditions in 1945 were unfavourable to the disease and it did not occur on any of the plots. The cost of the treatment is discussed.

BOWSER (P. H.). **Effects of DDT on Cabbage Maggot of Radish and on Aster Yellows and the Leaf Hopper of Head Lettuce : a Progress Report.**—*Quart. Bull. Mich. agric. Exp. Sta.* **28** no. 3 pp. 194–200, 1 ref. East Lansing, Mich., 1946.

Field experiments were carried out during 1945 in Michigan on the use of DDT against the Anthomyiid, *Hylemyia brassicae*, Bch., which had long been a pest of all cruciferous crops in the Upper Peninsula, and the Jassid, *Macrosteles divisus*, Uhl., which had been injurious to lettuce during the three previous seasons. A 25 per cent. wettable powder, which was applied as a dust or in the form of a spray made by mixing with water (1 lb. to 25 U.S. gals.), and a commercially prepared 5 per cent. mixed dust were used against both insects, and a bait of technically pure DDT ground and mixed with maize meal (1 : 19) was also tested against the Anthomyiid.

Experimental plots of radishes sown on 1st June were treated three times at weekly intervals, beginning ten days after the complete emergence of the seedlings. The DDT was used in all four forms, but none gave adequate control. Plots sown on 11th June were treated three times at weekly intervals beginning on the second day after complete germination, before the first true leaves were evident. In addition to the plots receiving the four original treatments, four plots were sown with seeds that had been dusted with 5 or 25 per cent. DDT ; two of these received no further treatment and in two the seedlings were also dusted. The seed treatments and the spray were of no value, and the bait was not very effective, but the plots dusted with 5 and 25 per cent. DDT had only 13 and 6 per cent. infested roots, respectively, as compared with 59 and 70 in the controls. The 25 per cent. dust caused severe scorching of the leaves, and the other dust slight scorching.

Control of *M. divisus*, which transmits the virus of aster yellows [*Chlorogenus callistephi* var. *vulgaris* of Holmes] to lettuce [*cf. R.A.E.*, A **29** 646], was tested on four crops sown at the usual times. The Jassid infestation is usually greatest in July–August, because the insects migrate from the hayfields when the grass is mown. Two lettuce varieties, Great Lakes and Imperial 456, were used ; in 1943 and 1944 the former appeared the more susceptible to the disease. Results were assessed at the time of cutting the heads. The first crop was set out in the field on 5th May, and cutting began on 5th July. DDT

applications were made on 18th and 25th June, to plots of 25 heads each. The 5 and 25 per cent. dusts and the spray gave 80, 88 and 80 per cent. heads free from disease, as compared with 72, 84 and 68 in untreated controls. The second crop was sown in the field on 5th May, and thinned to 50 heads per plot ; cutting began on 19th July. Treatments were given on 25th June and 2nd and 9th July. The results from the same material varied considerably from plot to plot, but the highest and lowest percentages of healthy heads of Great Lakes (84 and 70), and of Imperial 456 (86 and 66), were from plots treated with the 25 per cent. dust and spray, respectively, as compared with 56 and 44 in untreated controls. The third crop was sown on 20th May, and thinned to 50 heads per plot ; cutting was begun on 13th August. The insecticides were applied on 2nd, 9th, 23rd and 30th July, each to two plots of the Great Lakes variety, and there were two control plots. The percentages of heads free of disease were 64 and 66 for the spray, 62 and 68 for 5 per cent. dust, 70 and 76 for 25 per cent. dust and 36 and 40 in the controls. The percentages in two plots of Imperial 456 that received the 25 per cent. dust on the same dates were 70 and 80, as compared with 40 and 50 in the controls. Cutting from the fourth crop, which was sown on 5th July and thinned to 90 heads per plot, was begun on 17th September, two days after the first frost. DDT (25 per cent. dust only) was applied on 23rd and 30th July and 13th August. All the lettuces were Imperial 456, and the percentages of healthy heads in three dusted plots and a control were 91, 83, 90 and 56, respectively.

It is pointed out that, although the greatest yields in each crop were obtained with the 25 per cent. dust, high concentrations are costly and likely to result in high residues, so that they would be dangerous to use on lettuce except early in the season before the marketable portions develop. It is further suggested that frequency of application, rather than concentration, is important. Observations made in a commercial planting at Newberry, indicated that dusting all grass areas and hedges surrounding the lettuce field, to trap migrating Jassids, might give good results.

HANSBERRY (R.), CLAUSEN (R. T.) & NORTON (L. B.). **Variations in the chemical Composition and insecticidal Properties of the Yam Bean** (*Pachyrrhizus*).—*J. agric. Res.* **74** no. 2 pp. 55–64, 8 refs. Washington, D.C., 1947.

The tests described were carried out with 29 samples of seeds of *Pachyrhizus erosus* from various soil types and elevations in Mexico, Salvador, Guatemala, Florida and Hawaii and from a greenhouse in New York State, and one sample each of those of *P. tuberosus* from Peru, *P. strigosus* from Mexico, and *P. ahipa* from Argentina. All were finely ground and tested in talc (1 : 4) against third-instar larvae of *Epilachna varivestis*, Muls., on bean leaves, and all except *P. ahipa* were analysed chemically. The relationships between the place of origin and the insecticidal value of the samples of *P. erosus* were also studied. The following is based on the authors' summary. Toxicity was significantly correlated with resin content, rotenone content and three colorimetric analytical values, but not with the content of oil or of six compounds other than rotenone that were isolated from the samples. A colour test devised by T. M. Meijer is proposed as a suitable chemical method for indicating the approximate toxicity of yam-bean samples. Neither the toxicity nor the composition of the samples of *P. erosus* was affected by morphological variations or differences in the place of origin or habitat of the plants from which they were derived. *P. tuberosus*, *P. strigosus* and *P. ahipa* were all toxic to the larvae, giving 56, 77 and 48 per cent. mortality in four days, respectively, as compared with 28–84 per cent. for *P. erosus*. The survivors were nearly all paralysed and unlikely to recover.

ALKAN (B.). **Sitoks ilâcı ile zararlı böceklere karşı yapılan denemeler.** [Experiments with Cytox against injurious Insects.]—*Ankara yüks. Ziraat Enst. Dergisi* **9** no. 1 pp. 43–46. Ankara, 1947.

Experiments were carried out in Turkey in 1947 with Cytox, a wettable powder stated to contain 50 per cent. DDT. Some of them are noticed elsewhere [*R.A.E.*, B **36** 179]. A 0·25 per cent. suspension of Cytox in water did not prove very stable ; the powder had begun to settle after 13 hours and most of it had done so after a week. In laboratory tests, 32 larvae of *Hyponomeuta* collected from willow were placed on willow leaves in water in a cage and sprayed with the 0·25 per cent. suspension. Eight were found dead on the floor of the cage after 17 hours, and the remainder after nearly 24 ; none of the leaves had been eaten. A similar test was made with 20 larvae of *Euproctis similis*, Fuessly (*chrysorrhoea*, auct.), which were sprayed on apple shoots ; five were found paralysed on the floor after 8 hours, and the remainder after 20·5 hours ; all were dead after 42 hours. There was very little feeding on the leaves. In field tests, 55 larvae of *H. padellus malinellus*, Zell., from apple were placed on a young apple tree and sprayed with the suspension ; 22 had fallen to the ground after 18 hours and the remainder were inactive. All were dead on the ground after 26 hours. There were no signs of feeding or spray injury on the tree. Later, 18 larvae of *E. similis* and seven of *Malacosoma neustria*, L., were placed on a young cherry tree and sprayed. They began to fall from the tree after 20 minutes, and when replaced, again fell off. All were found dead on the ground after 23 hours. No feeding occurred after the treatment, and there was no spray injury to the tree. Both 0·25 and 0·5 per cent. suspensions were applied against *Hyalopterus arundinis*, F., on apricot and *Aphis pomi*, Deg., on apple, but proved ineffective.

VOÛTE (A. D.). **Regulation of the Density of the Insect-Populations in Virgin-forests and cultivated Woods.**—*Arch. néerl. Zool.* **7** pt. 3–4 pp. 435–470, 4 pp. refs. Leiden, 1946.

The author shows from the literature that outbreaks of insect pests occur far less frequently in virgin forests than in those established or managed by man [*cf. R.A.E.*, A **22** 370 ; **27** 386, etc.] and discusses at some length the operation of the various factors that regulate the population of forest insects, with examples from his own observations and those of other workers. In a region in which the climate is equable, the growth in population of a forest insect is checked primarily by biotic factors, in the first instance by polyphagous predators and parasites. Many of these will tend to specialise on the species in question, and they are eventually reinforced by monophagous parasites which increase as a result of the greater abundance of their host. If the population is still able to increase, the relative influence of the polyphagous parasites and predators declines, and the outbreak enters an " escape phase ", in which the population increases beyond the limit of its natural density. It may become stabilised at a high level or eventually enter a " crisis phase ", brought about by the effects of overcrowding, notably shortage of food and disease [*cf.* **35** 235, 236], and by a considerable increase of monophagous parasites. In the crisis phase, the population is reduced to a level that is within the limit of its natural density and is sometimes extremely low.

In regions that do not have an equable climate, such as the temperate zones, climatic influences are superimposed on the general scheme. Favourable conditions lead to an increase in population that may eventually reach the escape phase [*cf.* **35** 233, 236]. If it does, the outbreak may run its course, ending with a crisis, or be checked by a further climatic change. In countries

such as Holland, climate alone is sufficient to end an outbreak. Natural enemies are also affected by changes in climate, and in general, a changeable climate leads to a lack of stability in populations.

The transition from a virgin to a managed forest nearly always results in faunistic impoverishment, since fewer plant species are permitted and there are consequently fewer species of phytophagous insects. The introduction of exotic plants to replace native ones may also impoverish the insect community, since these plants are seldom accompanied by their insect enemies or the parasites of these enemies. A scarcity of phytophagous insects leads in turn to a reduction in the number of parasitic and predacious ones, and the chances that favourable weather conditions will lead to an outbreak are greatly increased. Attempts have recently been made in Holland to enrich unmixed pine stands by undersowing with native hardwoods supplemented by one or two species of exotic trees, and it is suggested that when exotic trees are imported in this way, consideration should be given to the desirability of importing also the insects that attack them and the natural enemies of these insects.

BOUDRU (M.). **L'état sanitaire, en Belgique, du sapin de Douglas** (*Pseudotsuga taxifolia*, **Britt.**).—*Parasitica* **2** no. 4 pp. 125–128, 7 refs. Gembloux, 1946. (With a Summary in Flemish.)

Pests of *Pseudotsuga taxifolia* that have recently been recorded in Belgium comprise three fungi and *Chermes cooleyi*, Gill., which was observed on this tree in two areas in 1940 and subsequently in many others, a list of which is given.

VAN DEN BRUEL (W. E.). **Sur la présence en Belgique d'un redoutable ravageur du fraisier** *Tarsonemus pallidus* **Banks** (**syn.** *T. fragariae* **Z.**).—*Parasitica* **2** no. 4 pp. 129–136, 2 pls., 1 ref. Gembloux, 1946.

Damage to strawberry similar to that caused by *Tarsonemus pallidus*, Banks (*fragariae*, Zimm.) has been observed in Belgium for several years and was particularly noticeable in 1937, but the mite itself was not found until 1946, when it was discovered on heavily infested plants in the Wépion district and later at Gembloux about 12 miles away. Damage in the Wépion area was severe and widespread ; many plants three years old were destroyed or badly stunted and considerable numbers of those two years old were also seriously affected, some of them giving only a quarter of their normal yield of fruit. Plants one year old appeared healthy, with the exception of a few infested leaflets. It was estimated that at least one-fifth of the entire strawberry crop in the area was destroyed. As *T. pallidus* was not recorded in Switzerland until 1928 [*R.A.E.*, A **17** 127] or in Holland until 1930 [**19** 242], and has not yet been observed in France, the author considers that its introduction into Belgium must have been comparatively recent. Information on its bionomics, on the damage it does and on its control by fumigating with methyl bromide, is reviewed from a paper by R. Wiesmann [*cf.* **30** 88] and reference is made to control by hot water treatment [*cf.* **22** 234, etc.].

Of the insect pests that attack strawberry in Belgium every year, the commonest and most injurious are Tipulid larvae, which can be controlled with bran baits poisoned with DDT or by watering the soil with an emulsified solution of DDT ; adults and larvae of *Galerucella tenella*, L., which defoliate the plants and kill the weaker ones ; *Anthonomus rubi*, Hbst., which appears to be increasing in importance [*cf.* **36** 278] ; *Rhynchites minutus*, Hbst., the females of which oviposit in the shoots ; Aphids, such as *Capitophorus fragaefolii*, Ckll., which was recorded near Bruges in 1935 ; and Lamellicorn larvae,

which cause local damage. Pests that are of occasional importance include Carabids, particularly *Harpalus rufipes*, Deg. (*pubescens*, Müll.), which injured the pulp of the fruits in one district some years ago by removing the seeds from them, and *Phyllobius oblongus*, L., the adults of which caused serious damage near Namur in 1946 by feeding on the leaves.

STRAWIŃSKA (J.). **Experiments on the Action of "Karbolin" on the Larvae** [of] *Lecanium corni* **Bouché.** [*In Polish.*] — *Ann. Univ. M. Curie-Skłodowska* (E) **2** no. 8 pp. 209–222, 4 figs., 20 refs. Lublin, 1947. (With a Summary in English.)

An account is given of experiments in Poland in 1938 in which three proprietary tar distillates were applied on 11th March against hibernating nymphs of *Eulecanium* (*Lecanium*) *corni*, Bch., on plum ; two of them proved effective, but the third was useless. The population counts from which the results were estimated were made by a special method. Areas of 4 sq. cm. were marked out on the bark of selected trees, five per tree, all the nymphs on these were removed and kept at 25°C. [77°F.] and those that regained activity in spring were counted. This was done on the trunks and branches 2–3 days before treatment and on the branches of treated and untreated trees 9 days after it. The results of the second count were confirmed by similar observations on 1,000 nymphs taken from the trunks of treated and control trees 11 days after treatment. The subsequent course of the infestation was followed by comparing the populations on lots of 100 leaves taken from the crowns of the trees in July and August and further counts from bark areas in November.

[KHRISTOV (A.).] **Христов (А.). A Method for Home-made Summer-oil Emulsion.** [*In Bulgarian.*]—*Annu. Univ. Sofia Fac. Agron. Sylv.* **25** livre 1 Agron. pp. 213–226, 30 refs. Sofia, 1947. (With a Summary in English.)

In view of the high cost of mineral oils and commercial emulsions of them in Bulgaria, tests were carried out in 1942–46 with a home-made emulsion of sunflower-seed oil, which is cheap and readily available. A stock emulsion is prepared by mixing 4 oz. soy-bean flour and 1 quart of a saturated solution of calcium hydroxide (lime water) in a mortar until a thick milky liquid is formed and slowly adding 1 quart sunflower-seed oil, stirring all the while until a thick creamy mass is obtained. This is diluted with the required amount of water and should be used at once, as fermentation sets in rapidly. Fermentation can be prevented by adding a few drops of concentrated ammonia solution. The emulsion can be used separately or in combination with Paris green, lead or calcium arsenates, colloidal sulphur, Bordeaux mixture or lime-sulphur.

In the tests, spraying with 0·5, 1 or 2 per cent. emulsions did not injure apples, and 0·5 or 1 per cent. emulsions applied in July did not injure pears, almonds, peaches, plums, cherries, raspberries and gooseberries. A 1 per cent. emulsion was very effective against *Aphis pomi*, Deg., on apple, and nymphs of *Eulecanium* (*Lecanium*) *corni*, Bch., on plum leaves were killed by immersing the twigs bearing the leaves in it. It did not give complete mortality of eggs of *Aporia crataegi*, L. The emulsion was also shown to have a fungicidal action by itself and to increase the effectiveness of fungicides with which it was used.

Černý (J.) & Drachovská-Šimanová (M.). **Řepařská fytopathologie. Škůdci a choroby řepy cukrové, jejich určování a ochrana proti nim.** [Beet Phytopathology. Pests and Diseases of Sugar Beet, their Identification and Control.]—233 [+4] pp., 100 figs. Prague, Hospod. Skup. čsl. Prům. Cukrovarn., 1947. Price 88 *Kčs.*

This handbook, which is written for growers of beet in Czechoslovakia, is divided into three main parts. The first (pp. 13–94) contains notes on the morphology, seasonal occurrence, distribution and control of various field pests and on the damage they cause. The pests are arranged according to their time of appearance on beet, and the great majority of them are insects. The second part (pp. 97–164) is devoted to diseases and includes a section on virus diseases in various countries. Those that occur in Czechoslovakia and have insect vectors are mosaic [*Marmor betae* of Holmes], which is transmitted by *Aphis fabae*, Scop., and according to Greis (1942) by *Myzus persicae*, Sulz., and *Empoasca* (*Chlorita*) *flavescens*, F. [*cf. R.A.E.*, A **20** 480], and crinkle [*Savoia betae* of Holmes], which is transmitted by *Piesma quadratum*, Fieb. A disease resembling virus yellows was observed in 1946 near Prague and also occurs in Moravia, but its identity is uncertain. The third part (pp. 167–190) deals with agricultural, chemical and mechanical measures for the prevention or control of pests and diseases. A key is included permitting the pests and diseases to be identified by the kinds of injury they cause and is arranged according to the successive stages of development of the plant and the parts of the plant attacked. There are also systematic lists of the pests and causal agents of diseases of beet plants.

Gabotto (L.). **Contro le malattie e gli insetti delle piante agrarie.** [The Control of Diseases and Insect Pests of Crops.]—6th edn., xvi + 462 pp., 186 figs., 5 refs. Casale Monferrato, Fratelli Ottavi, 1948. Price *L.*500.

This book on diseases and pests of cultivated plants in Italy is arranged under the principal crops and includes very brief notes on the bionomics and control of Arthropod pests of vines, olives, mulberry, *Citrus*, other fruit trees, cereals, forage plants, kitchen-garden crops, sugar-beet and many ornamental plants and trees. A section dealing in more detail with certain methods of control and a digest of the Italian plant pest legislation of 1921 are appended.

Brown (W. B.) & Lewis (S. E.). **A Comparison of Methyl Bromide and Hydrogen Cyanide for the Fumigation of empty Bags in Barges.**—*J. Soc. chem. Ind.* **65** pp. 241–245, 2 graphs, 10 refs. London, 1946.

The regular disinfestation of empty bags that have contained commodities subject to attack by insects is a valuable precaution against the spread of infestation. The treatment most commonly applied in Great Britain, in addition to mechanical cleaning, is fumigation with hydrocyanic acid gas, which is carried out in steel, hatched lighters. This fumigant is very highly adsorbed on vegetable fibres, so that it has been difficult to secure adequate penetration into bulks of empty bags, and special methods of bundling and stacking, a very high dosage and a fumigation period of at least 48 hours have been adopted. Furthermore, airing the bags is a very slow process, and a period of three or more days has often to be allowed before the bags can be safely unloaded.

Since methyl bromide penetrates into bales of fibre much more readily than other common fumigants, two tests were made with it in March and December, 1944. In the first, the bags were bundled and stacked in the manner considered necessary for treatment with HCN, and in the second, the results of which are analysed in detail, the bundles were stacked in the manner most convenient

for rapid loading. Immediately after airing in the second test with methyl bromide, and with minimum disturbance of the bags, the lighter was fumigated with HCN, so that the behaviour of the two fumigants could be compared.

The methyl bromide was introduced into the sealed hold through a tube fitted with a T-piece, the side-arms of which were directed to the two ends of the hold and bore fine spray nozzles, and this method proved very satisfactory. Liquid HCN, on cubes of gypsum, was scattered over the tops of the bundles by two men wearing respirators when all but one hatch at each end of the hold were sealed, after which sealing of the hold was completed. During each fumigation and airing period, samples of air were withdrawn from five points within bundles of bags in the bottom layer and two in the free space close to the hatch covers and from the adjoining cabin and chain locker through lengths of fine-bore lead tubing, and collected in evacuated flasks for the determination of concentrations of fumigant. In the second test, concentrations were also determined at two points within bundles in the top layer, and after treatment with methyl bromide, additional tests were carried out with a halide detector lamp. In the first test, the hold had a capacity of 4,500 cu. ft. and contained 10,000 empty grain bags and 5,000 empty rice bags. Fumigation was carried out with 9½ lb. methyl bromide for 44 hours at air temperatures of 6–8°C. [42·8–46·4°F.], and airing periods of 5½ hours and one hour were allowed on successive days. In the second test, in a hold with a capacity of 6,000 cu. ft. containing 17,770 grain bags, 11½ lb. methyl bromide was applied in four minutes and fumigation was continued for 48 hours, after which airing periods of 6 and 5¾ hours were allowed on successive days. The solid material of the bags was estimated to occupy about 500 cu. ft., and the bundles were laid flat to a depth of 5 ft. The temperature on top of the bundles fell from 9°C. [48·2°F.] to 6°C. in the 24 hours before fumigation and varied between 4·5 and 6·5°C. [40·1 and 43·7°F.] during fumigation. Fumigation with 20 lb. available HCN was continued for 48 hours, after which airing periods of 5, 6, 4¾, 5 and 9 hours were allowed on successive days. The temperature on top of the bundles varied between 5·5°C. [41·9°F.] and 8°C. during the 24 hours before fumigation and between 4°C. [39·2°F.] and 6·5°C. during treatment.

Measurement of concentrations in the second test provided striking evidence of the superior power of penetration possessed by methyl bromide, owing to the small amounts adsorbed. With this fumigant, the concentrations in the bottom bundles reached a maximum within the first few hours ; the subsequent fall in concentration was obviously due largely to leakage of gas from the hold, since towards the end of fumigation the concentration in the free space was generally less than that in the bundles. The concentration within the bundles fell rapidly during the first few hours of airing. With HCN there was little or no penetration to the centres of the bottom bundles during the first few hours of treatment, and maximum concentration was reached only towards the end of it ; the fall in concentration in the airing period was even slower than the rise during fumigation. The very large fall in concentration that occurred in the free space during fumigation and the slow penetration to the centres of the bundles, though partly accounted for by leakage from the hold, must be mainly ascribed to adsorption on the bundles. In two positions, there was a small rise in concentration after airing had begun, which must have been due to a slight stirring of the air within the bundles after the hold was opened.

Curves were plotted showing the variations of concentration with time, and concentration-time products obtained at each point were measured from these for fumigation periods of 24 and 48 hours and for various airing periods. These products were then expressed as percentages of the products that would be obtained if there were no loss of fumigant by absorption or leakage and if an even distribution were immediately attained, and these percentages were

used as a measure of the efficiency of the two fumigants from the point of view of distribution and penetration, but without taking into account their toxicity to insects. The efficiency of methyl bromide in the centres of the bottom bundles was 19–25 per cent. after 24 hours and 15–18 per cent. after 48 hours, the reduction being probably mainly due to loss of fumigant from the hold by leakage, and its efficiency in the top bundles was little different. The efficiency percentages for HCN in the bottom bundles were 0–0·4 after 24 hours, 0·1–0·9 after 48 hours and 0·3–2·7 during the airing period, whereas in the top bundles they were 2–2·7 after 48 hours and possibly double this when the concentrations during the airing period were included. Comparison of the results for methyl bromide in the two tests, allowances being made for differences in the period of fumigation and dosage, indicated that there was no significant difference in the efficiency of penetration to the lower bundles as a result of the different method of stacking, whereas the method of stacking probably has an appreciable effect with HCN. Published information on the toxicity of methyl bromide and HCN to insects at different temperatures is reviewed, and although it is considered that much additional information is needed, it is concluded that the dosages of methyl bromide used (34 and 31 oz. per 1,000 cu. ft., and 12·7 and 10·2 oz. per ton of bags) probably provided effective treatments under the conditions of the tests and would have been effective in treatments lasting only 24 hours at temperatures above 15°C. [59°F.]. The dosage of HCN (53 oz. per 1,000 cu. ft. and 17·8 oz. per ton of bags) was quite inadequate. The temperatures during the tests were much lower than desirable, but in Great Britain such conditions frequently cannot be avoided.

The concentrations of fumigant found in the free space before opening two days after airing had begun were about 4 and 22 per cent. of the concentrations at the end of the fumigation period for methyl bromide and HCN, respectively, and the concentrations in the bottom bundles were reduced by more than 90 per cent. and about 50 per cent. in the first 48 hours after the initial opening of the hold, indicating that the airing of bags proceeds more than five times as rapidly for methyl bromide as for HCN. Tests in holes formed by removing about a dozen bundles of sacks showed sufficiently low concentrations of methyl bromide on the first and second days of opening to suggest that it would normally be permissible to unload 24 hours after the initial opening, provided that the hold had been open to the air for at least six hours and that the hatches had been completely removed for at least an hour before unloading was begun. Similar tests showed that several days must be allowed for airing after the use of HCN, since it proceeded at a very slow rate, though the method of stacking and possibly also the low temperatures prevailing during the trials may have had a greater effect on the airing than in the case of methyl bromide. In each fumigation, there was considerable leakage of gas into the cabin and chain locker, so that it would be wise to prohibit the use of these compartments until the hold has been unloaded.

It is concluded that methyl bromide is much more suitable than HCN for the fumigation of empty bags in lighters. Except under the most adverse conditions, the fumigation period could be reduced to 24 hours, and unloading could normally begin 24 hours after the end of fumigation. In addition, there is no need for the special method of stacking that has been considered essential for treatment with HCN.

SMITH (K. M.). **A Textbook of agricultural Entomology.**—2nd edn., $8\frac{1}{2} \times 5\frac{1}{2}$ ins., xiii+289 pp., frontis., 84 figs., many refs. Cambridge, Univ. Press, 1948. Price 18*s*.

This second edition of a text-book on insect pests of farm crops and stock in Great Britain closely resembles the first [*R.A.E.*, A **19** 143], but the information

on the bionomics has been brought up to date where necessary, and that on control is extended in a few instances to indicate results obtained with recently developed synthetic insecticides. The chapter on insects in relation to virus diseases of crops has been rewritten.

MASSEE (A. M.). **Notes on some interesting Insects observed in 1945.**—*33rd Rep. E. Malling Res. Sta. 1945* pp. 90–95. East Malling, 1946.

Pristonychus (*Laemostenus*) *terricola*, Hbst., damaged apples kept in dry storage in the cellars of houses in a district of Kent in October 1945. The beetles fed on dessert apples at night but did not touch culinary varieties. This Carabid is locally common in outhouses and sand-pits and under leaves and stones in woodland. Adults of the Lamiid, *Tetrops praeusta*, L., which is widely distributed in the southern half of England, were seen emerging from the tips of spurs of old pear trees at East Malling. Most of them appeared during the latter part of April and at once began to feed on the foliage. They fed only on the epidermis, causing very little harm, and probably occur only in old and neglected orchards. *Rhynchites coeruleus*, Deg., was widespread and caused injury, particularly to young trees, by cutting off the new growth in May and June. The damage was considerable on apple, pear, plum, cherry, peach and nectarine in Kent, and on laurel bushes and wistaria plants in Hampshire. This weevil overwinters in the adult stage among dead leaves, under loose bark and in sacking bands. Injury to young apple fruits by adults of *R. aequatus*, L., was general and in some instances serious in Kent. The weevils were numerous on the trees during the flowering period and began to puncture the fruits soon after petal fall. Many of the punctures contained eggs, and the larvae were abundant in the fruits two weeks after petal-fall. Annual observations since 1937 have shown that *R. germanicus*, Hbst., is the only species of the genus injurious to strawberry. *R. minutus*, Hbst. (*aeneovirens*, Marsh.), which was formerly thought to infest strawberries, is associated with trees such as oak and mountain ash [*Sorbus aucuparia*] and did not feed on wild or cultivated strawberry when placed on them. *R. germanicus* was abundant in 1945 and was reported on strawberry in Kent, Essex and Leicestershire. The adults were prevalent in April, a month earlier than in some seasons, and cut off the petioles and blossom stalks over large areas of strawberry beds. They had also damaged all the new laterals in a ten-acre field of blackberries in Kent by the first week of May and were attacking loganberries in an adjoining field, but were very effectively controlled by dusting with 40 lb. per acre of 5 per cent. DDT or 5 per cent. benzene hexachloride.

Scolytus rugulosus, Ratz., which is usually associated with damson and plum, was found infesting the spurs of pear in two widely separated parts of Kent. Adult emergence began on 14th April and continued for several weeks. *Xyleborus* (*Anisandrus*) *dispar*, F., infested unhealthy apple trees growing in waterlogged soil in Essex and sweet cherries suffering from bacterial canker [*Pseudomonas*] in Kent ; the cherry trees were also infested by *X. xylographus*, Say (*saxeseni*, Ratz.). Adults of *Otiorrhynchus singularis*, L., injured raspberry in several places in Kent, and adults and larvae of *O. sulcatus*, F., attacked strawberry and hops grown in pots at the Research Station, but not neighbouring raspberry plants. The adults of *O. sulcatus* were not affected by DDT dust. Adults of *Polydrusus cervinus*, L., fed on the foliage of apple, pear, plum, cherry, nut [*Corylus*] and hawthorn [*Crataegus*] at East Malling during the last week of May, but the damage by this weevil was negligible compared with that caused by several species of *Phyllobius*. A single example of *Polydrusus sericeus*, Schall., was found feeding on a Waterloo cherry leaf in the same district.

Many males of *Erannis leucophaearia*, Schiff., were received for identification early in 1945. The normal food-plant of this Geometrid is oak, but the wingless females can be found in small numbers on the trunks of apple in February throughout the fruit areas of Kent, and the larvae, which feed in April and May, add to the damage caused by other species of the winter-moth group. Adults of the winter moth [*Operophtera brumata*, L.], the mottled umber [*E. defoliaria*, Cl.] and other members of this group were abnormally common on fruit trees in Kent and Essex in December 1945, though the larvae had not been unusually abundant in the orchards in the preceding spring. Larvae of another Geometrid, *Itame wauaria*, L., were reported feeding on the foliage on gooseberry and gooseberry-currant crosses; they are present in May and June, pupate in the soil and give rise to adults in July. *Nepticula malella*, Staint., was reported from the Bedford district in the autumn of 1944 and also mines the leaves of apple occasionally in Kent. There are two generations a year.

Since *Hoplocampa flava*, L., became a major pest of plum in south-eastern England in 1930, its importance near Maidstone has varied from year to year. It was scarce in many parts of Kent in 1945, although the apple sawfly [*H. testudinea*, Klug] was common in the same districts.

Coniopteryx tineiformis, Curt., which is usually associated with forest and shade trees in England, has not been observed in orchards in Kent, but the larvae are sometimes plentiful on apple in Essex; they are predacious on all stages of the fruit-tree red spider [*Paratetranychus pilosus*, C. & F.], which is common on apple in Essex. Adults of the two generations of this lacewing emerge in May or June and in August. The prepupae overwinter in cocoons on the trunks of the trees and are not affected by dormant sprays of tar distillate or oil emulsion.

Tarsonemus pallidus, Banks, became a serious pest of strawberry in many parts of Kent, Hampshire, Worcestershire and Cambridgeshire in the dry summer of 1945, and growers were advised to procure runners for planting new beds from a source where it was not prevalent. If its presence is suspected, it is essential to carry out the warm water treatment prior to planting [*cf. R.A.E.*, A **22** 234], as there is no method of obtaining adequate control under field conditions; DDT and benzene hexachloride have no effect on it.

Dicker (G. H. L.). **The Apple Blossom Weevil and its Control.**—*33rd Rep. E. Malling Res. Sta. 1945* pp. 140–141. East Malling, 1946.

An account is given of recent observations in south-eastern England on the bionomics and control of the apple blossom weevil [*Anthonomus pomorum*, L.]; the most important discovery was the actual time of oviposition [*cf. R.A.E.*, A **36** 314]. The larvae devour all the flower but the petals before the pink-bud stage, when they are fully grown. The investigations on the control of the overwintered adults with dusts of DDT and benzene hexachloride [**35** 211] have already been noticed. The results of field tests with sprays indicate that they can be effectively controlled by spraying once at bud burst with 0·1 per cent. DDT. This spray should be applied about a fortnight before the routine lime-sulphur spray at the green-cluster stage and will normally constitute an addition to the spray programme. Lime-sulphur can safely be mixed with DDT, but it is inadvisable from the point of view of controlling scab [*Venturia inaequalis*] to add lime-sulphur to the bud-burst spray at the expense of omitting one of the normal pre-blossom scab sprays.

Massee (A. M.). **Overwintering of the Woolly Aphid Parasite** (*Aphelinus mali* **Hald.) in Low Temperature Apple Stores.**—*33rd Rep. E. Malling Res. Sta. 1945* pp. 142–143, 2 refs. East Malling, 1946.

When *Aphelinus mali*, Hald., is introduced into apple orchards in England for the control of the woolly Aphid [*Eriosoma lanigerum*, Hsm.], it may be unable

to survive the damp winters, may migrate or die out when it has reduced the Aphid population to a minimum and so permit reinfestation, or may be reduced in fecundity by weather conditions or other causes. It is therefore desirable to keep a supply of the parasite from one season to the next, so that it can be reintroduced where necessary, and for this purpose, experiments were carried out in Kent and Essex on its overwintering in cold storage or dry storage [*cf. R.A.E.*, A **33** 361]. In Kent, shoots of Cox's orange pippin bearing suitable colonies of parasitised Aphids were freed from predacious insects and kept on trays in a cold storage chamber at a constant temperature of 45°F. or in dry storage in a boarded loft from 20th October 1943 until 19th May 1944, when they were taken from the store and lightly damped with tap water at room temperature by means of an atomiser. Parasite emergence began on the twigs from cold storage on 1st June and reached a maximum on 8th June. The newly emerged parasites were liberated in an infested orchard and readily attacked the Aphid colonies, becoming firmly established during the summer and greatly reducing the population of *E. lanigerum* by the end of September. No parasites emerged from the shoots kept in dry storage, and subsequent experiments confirmed that this method was unsuccessful. A similar experiment was carried out by a grower, who kept the shoots in a commercial apple store at 39°F. from October 1943 to the end of May 1944, when they were put in an orchard where the parasites successfully emerged in June.

In Essex, shoots bearing parasitised Aphids were kept in a commercial gas store at 39°F., except for a few days in the coldest part of the winter, when no temperature control was maintained, from the middle of October 1944 to the first week in June 1945 ; they were distributed in Essex and Kent, and the parasites emerged successfully during the second week of June and established themselves.

The advantages of this method of preserving the parasites and the precautions to be taken in using it are discussed. The shoots should be collected on a dry day in October, laid in a single layer in suitable boxes and kept at a constant temperature between 39 and 46°F. until the end of May. In the orchard, a bunch of ten or twelve shoots should be tied to a badly infested tree, as the parasites may fail if only a few individuals are liberated in an orchard.

Speyer (R. R. [*i.e.* E. R.]) & Parr (W. J.). **Animal Pests.**—*31st Rep. exp. Res. Sta. Cheshunt 1945* pp. 66–79, 3 refs. Cheshunt, Herts., 1946.

In view of recent observations on the distribution of *Tetranychus telarius*, L., on tomato plants in glasshouses in Hertfordshire during the early part of the growing season [*R.A.E.*, A **35** 325, etc.], the effect was tested in 1945 of spraying a few rows of plants on each side of the central ridge soon after the appearance of feeding marks of the mite on the foliage, in order to control the initial infestation and obviate the necessity for later repeated spraying of all the plants. The mites made an abnormally late appearance. On 28th May, the four centre rows, which were immediately below the ridge and were infested by mites dropping from this after hibernation, were sprayed with a proprietary oil emulsion (1 : 100). Water was withheld from the roots of the plants for three days before and four days after the application. Examination on 1st June showed some mites and newly deposited eggs on the four middle rows and two small patches of infestation in one adjacent row. On 5th June, the four centre rows and one each side of them were sprayed, and on 20th June, infestation in these rows was very slight, and except on a single plant, the new foliage was free from mites. So far as could be ascertained, no mites were present on the unsprayed plants. In a similar untreated house, a moderate to severe infestation had developed in the four middle rows by that date, and had spread on

each side in some places through five rows to the plants adjoining the gutter. By 19th July, the infestation in the first house was insufficient to necessitate further control, whereas in the other, in spite of a spray two weeks before, it was very severe on the four middle rows and considerable throughout the house. The plants that were sprayed twice began to develop oedema about 14 days after the second application, and large areas of dried tissue appeared during July on lower portions of the stems and on truss-stalks (chiefly those from which the fruit had already been gathered), but secondary infection by *Botrytis* was slight and very little fruit fell prematurely. No oedema developed on the plants sprayed once only. Although a single application might control the mite, some risk is involved, especially as, in normal years, the work would have to be carried out not later than the end of April, and the necessity for withholding water for a few days from the roots of some of the plants in a house would seriously interfere with the system of watering practised in a nursery.

Further tests were made with two of six proprietary oil emulsions previously tested against *T. telarius* on tomato [*cf.* **33** 404], applied alone or with 0·25 per cent. calcium chloride to heavily infested plants 42 ins. high on 14th June or alone on 14th and 18th June. The results showed that the percentages of new leaves showing feeding marks five weeks after treatment were 78 for a single application of the first emulsion, 26 and 16 for single applications of the two emulsions with calcium chloride and 20 and 19 for the double applications, as compared with 78 after three weeks for no treatment. When 0·5 per cent. sodium chloride was substituted for calcium chloride, a considerable quantity of oil was thrown out of emulsion and the results were most unsatisfactory. It is therefore suggested that the calcium chloride causes the particles of oil in emulsion to adhere to the integument of the mites rather than that increased mortality is brought about by a partial liberation of free oil from emulsion.

Investigations on the control of Aphids on lettuce with hydrocyanic acid gas generated from sodium cyanide and 33 per cent. sulphuric acid (2 : 9 w/v) [*cf.* **35** 325–326] were carried out in a greenhouse with a capacity of 4,800 cu. ft. containing almost mature lettuce in the ground, seedling and young lettuces in boxes and pots and some plants of *Nicotiana* on staging ; the older lettuce and *Nicotiana* were infested with *Macrosiphum* (*Myzus*) *solani*, Kalt. The duration of each fumigation was 16 hours. At a dosage of $\frac{1}{6}$ oz. sodium cyanide per 1,000 cu. ft. space and temperatures of 49–60°F., the fumigant had no effect on plants or Aphids but killed nearly all the adult whiteflies [*Trialeurodes vaporariorum*, Westw.] on the *Nicotiana*. At $\frac{1}{4}$ oz. per 1,000 cu. ft. and 52–64°F., the plants were uninjured, and 83 per cent. of the Aphids in the first three instars and the majority of the fourth-instar and mature apterae were killed, but all the fourth-instar and mature alates survived. At $\frac{1}{2}$ oz. and 45–65°F., the foliage of the mature lettuce plants was severely scorched, but the seedlings, young lettuces and *Nicotiana* were less severely damaged and subsequently made good growth. No living Aphids could be found after the fumigation. The control obtained with $\frac{1}{4}$ oz. sodium cyanide was satisfactory, probably owing to the destruction of a very high proportion of young nymphs. An experiment showed that the fecundity of alates that had survived fumigation with this dosage was not reduced and, since the progeny developed normally on fumigated plants, it was concluded that sufficient HCN was not adsorbed on the leaf surface to be toxic.

Macrosiphum solanifolii, Ashm., which the authors consider identical with *M. gei*, Koch, breeds on *Abutilon*, carnation, *Cyphomandra*, lettuce, and, less frequently, tomato in glasshouses at the Cheshunt Station. It has two colour forms, green and red, and in the parthenogenetic generations they breed true to their particular colour. No sexual forms have been found at Cheshunt. In 1944–45, the green form occurred on carnation throughout the winter and

spring, but on 9th July, the alates migrated and many of the apterae showed peculiarities of structure. These apterae produced few young, and the infestation died out during August. In the middle of October, alates returned and began to breed, but large colonies were confined mainly to plants that had developed flower stalks, on which the Aphids congregated shortly before reaching maturity. From July to September, lettuce and potato growing out of doors near the glasshouses were infested. In February 1944, considerable difficulty was experienced in establishing the green form from carnation on lettuce on which the red form had been breeding freely for some time, and in July–December 1945 a series of host-transference experiments was carried out. A critical examination of the structure of the Aphids employed and of their progeny showed that all belonged to the same species. Alates and apterae of the green form were tested on carnation, lettuce, tomato and potato. The results indicated that carnation, although sometimes subject to severe infestation by this Aphid, does not supply it with all its nutritional requirements. After prolonged breeding on carnation, the mature insects tend to become short-lived and often do not produce young after transfer to suitable food-plants, such as lettuce and potato ; in this respect, alates appeared to be less adversely affected than apterae. When young were produced, many did not develop successfully, but those that reached maturity produced many young, and normal fecundity was regained by the third generation on a suitable food-plant. There was an increase in average size in the three successive generations after the parent had been transferred from carnation to lettuce, but after transfer from lettuce to carnation the progeny of the first generation were much smaller than their parent, and no significant difference was shown in the next two generations. Alates and apterae from small colonies of the red form on tomato were transferred to pot plants of tomato, Turkish tobacco and *Hyoscyamus niger* in May, and examination in June showed that the Aphids had made unsuccessful attempts to establish themselves on the two former, but that apterae were breeding on *Hyoscyamus*. During July, alates appeared on *Hyoscyamus*, and alates and apterae were transferred to carnation. They produced very few young, and these failed to develop beyond the second instar. Of the many young produced by alates that settled on a carnation plant on which a flower stalk was developing and apterae that wandered on to its foliage, only six (all apterae) completed their development ; they did so slowly and died without progeny. Alates of the red form were also transferred from *Hyoscyamus* to potato, and alates and apterae from potato to lettuce and from lettuce to tomato. They bred freely on lettuce and potato but not on tomato. The sap of the tomato possibly contains some substance toxic to Aphids, but if this is so, its distribution in the tissues of the plant appeared not to be uniform. Observations are recorded as to the parts of the plants on which the mature forms produced their young and on the movements of the developing nymphs.

Reproduction of *Thrips tabaci*, Lind., is usually parthenogenetic, and the occurrence of males is extremely rare. However, males were found on leeks grown out of doors at Cheshunt in October 1944, when the thrips was breeding in profusion on these plants, and again in May 1945.

COMMON (I. F. B.). **Control of Corn Ear Worm on Tomatoes.**—*Qd agric. J.* **66** pt. 2 pp. 102–104. Brisbane, 1948.

Combined dusts of lead arsenate, sulphur and copper carbonate (5 : 3 : 2) or sprays of 1½–3 lb. lead arsenate, 1 lb. colloidal sulphur and 2½ lb. copper oxychloride in 50 gals. water have been in general use on tomatos in Queensland for the control of *Heliothis armigera*, Hb., *Phyllocoptes lycopersici*, Massee, and various fungous diseases. However, these treatments do not always

control *H. armigera* when infestation is severe, and effective deposits leave a very heavy residue. In tests carried out in central Queensland, fortnightly applications of a dust containing 2 per cent. DDT, with or without sulphur, gave control of *H. armigera* comparable with that given by weekly applications of the combined dust, but they did not control *Plusia argentifera*, Gn., and the inclusion of copper carbonate or copper oxychloride in the DDT dust markedly reduced its effectiveness. DDT dusts cannot therefore be recommended for general use on tomatos, but they might be of value in districts in which *Empoasca terrareginae*, Paoli, and *Gnorimoschema operculella*, Zell., are pests, since the latter are controlled by DDT but not by lead arsenate. In these districts, a dust containing 2 per cent. DDT and 30 per cent. sulphur should be applied fortnightly, and each application should be followed a week later by a fungicidal dust containing 7–10 per cent. copper. If dusts are used in districts in which *H. armigera* and *P. argentifera* are the major pests, the standard combined dust should be applied weekly, with an occasional extra treatment with DDT when *H. armigera* is very active.

In further experiments, DDT sprays were consistently more effective than DDT or lead-arsenate dusts against *H. armigera*. When a spray containing 0·2 per cent. DDT was applied fortnightly from the beginning of flowering, losses of fruit were very low, and it appeared that both sulphur and copper oxychloride could be incorporated in the spray with little or no effect on the toxicity of the DDT. It is concluded that fortnightly applications of a spray containing 2 lb. 50 per cent. water-dispersible DDT powder, 2 lb. wettable sulphur and 2½ lb. copper oxychloride per 50 gals. water should give very good control of *H. armigera* and also check *Phyllocoptes lycopersici*, *G. operculella*, Jassids and fungous diseases. Treatment should be applied from the time when the plants begin to flower until picking has reached its maximum.

RICE (E. B.). **Queensland Cheese Production.**—*Qd agric. J.* **66** pt. 2 pp. 107–111. Brisbane, 1948.

It is stated in the course of this paper (pp. 108–109) that in view of reports from England of the infestation of Australian cheese by mites, experiments were carried out in Queensland in 1946–47 on the effectiveness against a species of *Tyrophagus* (referred to as *T. putrescentiae*, Schr. [*cf. R.A.E.*, A **31** 69, 157]) of dichlorethyl ether [*cf.* **33** 130] applied as an atomised spray at the rate of 1 lb. per 1,000 cu. ft. in cheese-factory curing rooms. After the first treatment, the room was closed for 48 hours, then opened and aired, and all cheeses turned on the shelves. A second treatment was then given and the room again closed for about 72 hours. All mites on exposed surfaces were killed, but mites under cheese and some of those in cracks were not affected. It is thought that the treatment could be applied in all cheese factories to keep the curing rooms free from mites, as the cost would be small even if it were found that two or three applications are needed yearly. A method of using dichlorethyl ether in gaseous form has been evolved for the treatment of large cheese-maturing rooms, such as those at central cold stores, and trials with it are in progress.

GREAVES (T.). **The Control of Silverfish and the German Cockroach.**—*J. Coun. sci. industr. Res. Aust.* **20** no. 4 pp. 425–433, 3 figs., 7 refs. Melbourne, 1947.

Houses and libraries in Queensland, New South Wales, Victoria and South Australia are commonly infested by *Ctenolepisma longicaudata*, Escherich [*R.A.E.*, A **29** 55], but in 1941, about 1,000 silverfish collected in Brisbane for

experimental purposes were all found to be *C. urbana*, Slabaugh. This species was later observed in Canberra, where, however, *C. longicaudata* apparently predominates. The use of barium-fluosilicate bait cards [**27** 510] gives satisfactory control of *C. longicaudata* in houses, but not in offices, where it finds plenty of alternative food. Regular six-monthly treatments with a spray containing 0·17 per cent. w/v pyrethrins caused a marked reduction in Government offices, but its use was partly abandoned during the war, and silverfish again became abundant. Service establishments in the Canberra district were dusted with DDT for the control of *Blattella germanica*, L., during 1939–45 [B **36** 179], and it was then noticed that silverfish were also effectively controlled in the treated premises. Further tests were accordingly made, and the following is based on the author's summary of them. Successful control of *C. longicaudata* was in general achieved by the application of 1–1½ lb. dust containing 10 per cent. p,p'DDT to houses having 6–8 rooms each in Canberra. The dust was applied by means of a hand dust-gun, fitted with a fish-tail nozzle, to crevices, behind skirting, architraves, and cupboards and to other similar sites. In some cases, repeated treatment in this manner failed to give complete control, especially in the upper parts of the houses, but when a further ½ lb. of dust was applied to the upper surface of the ceilings all the remaining silverfish were killed. In offices, a spray containing 0·17 per cent. pyrethrins and 4 per cent. DDT in deodorised kerosene was found effective for treating open filing racks and similar equipment in daily use and should be used to supplement the dust treatment. Reinfestation of houses was found to take place from wood heaps, and this should be prevented by clearing away all wood débris from these sites at least once a year and treating the lower part of the stacked wood with ¼–½ lb. 10 per cent. DDT dust.

A dust containing 5 per cent. DDT would probably be effective against silverfish [*cf.* **35** 178], but since a 10 per cent. dust is necessary to control *B. germanica* and is likely to remain effective for a longer period, it appears to be the more suitable for general household use.

Powning (R. F.). **The sub-surface Atmosphere of Wheat infested with** *Rhizopertha dominica* **F.**—*J. Coun. sci. industr. Res. Aust.* **20** no. 4 pp. 475–482, 4 figs., 7 refs. Melbourne, 1947.

F. Wilson showed that insect infestations in wheat stored in bulk are restricted to the superficial layers and that this is attributable to unfavourable temperature and humidity at greater depths [*cf. R.A.E.*, A **34** 121 ; **36** 182, etc.], but before this discovery, the influence of the composition of the atmosphere between the wheat grains on infestation by *Rhizopertha dominica*, F., was investigated in Victoria. The preliminary laboratory studies were made at 90°F. and 65 per cent. relative humidity on conditioned wheat in open jars 5 ft. high and 3 ins. in internal diameter, to the top or bottom of which were added 500 adults of the beetle. The experiments lasted for eight weeks. When the insects were added at the top, they distributed themselves evenly throughout the wheat in a fortnight. All those at depths below 1 ft. died within a month, by which time the carbon-dioxide concentration there was 15–20 per cent., but many second-generation adults developed in the upper 2 ft. When the beetles were added at the bottom of the jar, they showed little tendency to move upwards, although the concentration of carbon dioxide there exceeded 10 per cent. after a week. There was little breeding, and mortality was high after a month, but some of the original insects survived until the end of the experiment, when the carbon-dioxide concentration reached 18 per cent. at the bottom. Uninfested wheat in open jars developed less than 0·5 per cent. carbon dioxide in four weeks.

Analyses of the atmosphere between the grains of wheat stored in bulk did not indicate the presence of gases other than the normal constituents of air. In uninfested wheat, the temperature and carbon-dioxide content increased slightly with depth, but became constant below about 3 ft. In slightly infested wheat, insects, mainly *R. dominica*, occurred throughout the whole depth sampled (5 ft.), but most were concentrated within 18 ins. of the surface, and in this region there was a corresponding increase in temperature and carbon-dioxide content and a decrease in oxygen content. Similar conditions prevailed in heavily infested wheat, but there were fewer insects at depths below 2 ft. The concentration of carbon-dioxide rose to about 2·5 per cent. where the density of insects was greatest ; it was never as high as 3 per cent., and that of oxygen was never more than 3 per cent. below normal.

The tolerance of *R. dominica* to concentrations of carbon-dioxide as high as 5–10 per cent. and the absence of any reaction to a gradient of carbon-dioxide concentrations confirm Wilson's conclusion that the limitation of infestation to the periphery of bulk wheat is adequately explained by conditions of temperature and humidity.

SHANAHAN (G. J.). **B. H. C. (Benzene Hexachloride) and Mushroom Pests. A promising Means of Control.**—*Agric. Gaz. N.S.W.* **59** pt. 4 p. 184. Sydney, 1948.

The chief pests of cultivated mushrooms in New South Wales are Tyroglyphid mites, of which the most injurious is a species of *Tyrophagus* referred to as *T. putrescentiae*, Schr. [*cf. R.A.E.*, A **31** 69, 157], Collembola and *Sciara* sp.; and Tarsonemid mites thought to be *Pigmeophorus americanus*, Banks (a species not previously recorded in the State that is reported to inhibit the growth of mushrooms by feeding on the mycelium [*cf.* **31** 205]) have recently appeared in great numbers on commercial mushroom beds. Since laboratory tests showed that dusts of benzene hexachloride were toxic to the species of *Tyrophagus*, the effect of 10 and 20 per cent. benzene-hexachloride dusts (1·3 and 2·6 per cent. γ isomer, respectively) on various mushroom pests was tested in commercial beds. Surface application of the weaker dust at 1 oz. per 6 sq. yds. caused the practical disappearance of the Tarsonemids from a treated bed. It was also dusted over the surface at 2 oz. or 4 oz. per 4·5 sq. yds. or mixed with the compost at 1 lb. per 2½ cwt. for the prevention of infestation by Tyroglyphids, but as few mites appeared in the treated control beds, the results were inconclusive. The stronger dust at 1 oz. per 40 sq. ft. controlled the Tarsonemids, eliminated Collembola (*Onychiurus ambulans*, L.) within 24 hours and reduced the adult population of *Sciara* sp.

The 10 per cent. dust at 1 oz. per 6 sq. yds. did not affect mushrooms in the button stage and imparted no undesirable flavour to mushrooms in various stages of development, though slight scorching of the upper surface became evident on cooking. When the beds were deliberately over-dusted, the scorching was evident in freshly picked mushrooms. In the test against the Tyroglyphids, the dust did not affect the growth of the mycelium and did not appear to taint the mushrooms.

MAGEE (C. J.). **Woodiness or Mosaic Disease of Passion Fruit.**—*Agric. Gaz. N.S.W.* **59** pt. 4 pp. 199–202, 208, 5 figs. Sydney, 1948.

A detailed description is given of the symptoms of the woodiness or mosaic disease of passion fruit [*Passiflora edulis*] in New South Wales [*cf. R.A.E.*, A **27** 448], where it reduces the vigour of the vines and consequently the life of an infected plantation and affects the quality of the fruits. It is caused by Cucumber virus 1 [*Marmor cucumeris* of Holmes], which occurs in various plants

and is transmitted by several species of Aphids, including *Myzus persicae*, Sulz., *Macrosiphum solanifolii*, Ashm., and *Aphis gossypii*, Glov. [*cf. loc. cit.*]. Since there do not appear to be any means of preventing it from eventually affecting every plant in a plantation, the only measures likely to be of value are those directed at restricting its severity by providing favourable growing conditions for the vines.

DARLING (H. S.). **Annual Report of the Agricultural Entomologist.**—*Rep. Dep. Agric. Uganda 1944–45* pt. 2 pp. 25–30. Entebbe, 1946.

A few mature swarms of *Schistocerca gregaria*, Forsk., occurred in Uganda in Karamoja during July–September 1944. They oviposited in August, but most of the resulting hopper bands, which totalled some ten square miles in area, were destroyed by means of poison bait. One adult swarm was formed, however, and both it and other immature swarms from north-western Kenya flew westwards across north-eastern Uganda during October–November. They had matured by the beginning of December and ranged over northern and north-eastern Uganda, where they gradually died out. Eggs were laid in Karamoja and hatched in January 1945, but the resulting hoppers were destroyed by control measures. During February, several small immature swarms from north-western Kenya flew across the northern part of Uganda, where they continued to move about during March. Late in that month, several more entered south-western Uganda from Ruanda and became mature during April as they moved north through western Uganda and the north-east of the Belgian Congo ; a large mature swarm was reported in West Nile, near the Belgian-Congo border, on 22nd April. It is thought that these swarms subsequently reached the Anglo-Egyptian Sudan, where a large mature swarm was reported from Juba on 30th April. During April and May 1945, the swarms in northern and north-eastern Uganda gradually matured and retreated into Karamoja, where eggs were laid in the Suk area in late May ; large bands of hoppers resulted but were destroyed in June. Damage to crops by adults was reported from six districts during the year.

Dysdercus nigrofasciatus, Stål, and *D. superstitiosus*, F., migrated to cotton at Serere in early July ; populations were still low at the end of October, but second rains continuing well into December caused a heavy infestation to develop at the end of the season. *D. cardinalis*, Gerst., which normally occurs in small numbers, was not observed. Infestation by Jassids [*Empoasca*] was moderately severe on glabrous varieties of cotton, but attack by *Helopeltis* [*bergrothi*, Reut.] was insignificant and that by *Lygus* [*vosseleri*, Popp.] normal [*cf. R.A.E.*, A **35** 340]. *Argyroploce leucotreta*, Meyr., began to attack early cotton in August and was more injurious than either *Platyedra gossypiella*, Saund., which was not observed on cotton until October, or *Earias* spp., which were present in small numbers in June. At Kawanda, young shoots of cotton were attacked by *Lygus* in early December, when this Mirid is not usually present but the conditions were abnormal owing to the prolonged second rains. Counts of *Dysdercus* made on 33 plants in a block of April-sown cotton on 30th November indicated a population of about 30,000 adults per acre, of which 98 per cent. were *D. fasciatus*, Sign., and the rest *D. nigrofasciatus* ; this cotton was burned immediately afterwards. Further counts were made at fortnightly intervals between 4th December and 12th February in other April-sown and in July-sown blocks. During this period, the adult population averaged about 8,000 per acre, and consisted mostly of *D. fasciatus* and *D. nigrofasciatus*, with less than 5 per cent. *D. superstitiosus*. The numbers per acre rose from about 5,000 in December to an average of over 14,000 in late January and early February, mainly owing to an increase in numbers of *D. fasciatus*, which averaged 8, 45 and 70 per cent. of the population in December, January and

February, respectively. No previous local records of population are available but this infestation is thought to be particularly heavy. Of 7,500 bolls examined in late December, 46 per cent. were damaged by *Dysdercus* spp., 1·3 per cent. by *A. leucotreta*, 1·2 per cent. by *P. gossypiella* and 0·5 per cent. by *Earias* spp.

Populations of 25–30 adults and nymphs of *Antestia* spp. per tree were found in December on *Coffea canephora* at Kakumiro. Many berries remained on the trees, which were growing near trees of *C. arabica* from which the crop had recently been harvested. *A. lineaticollis*, Stål, comprised 60 per cent. of the population and *A. faceta*, Germ., the rest. No parasites were found in adults or nymphs of *Antestia* collected on coffee in Mubende, Toro and Ankole, but up to 100 per cent. of the eggs were parasitised by *Microphanurus* spp.

Attempts in September 1944 to recover *Plaesius javanus*, Er., the predacious Histerid that was introduced from Java in 1934 and 1935 and liberated on Kibibi Island, Lake Victoria, against *Cosmopolites sordidus*, Germ., on banana [*cf.* **25** 352] were unsuccessful, and it is concluded that it did not become established. Larvae of *Acraea acerata*, Hew., completely defoliated some plots of sweet potato at Kawanda during December–February; infestation by this Nymphalid appears to have been general in much of southern and western Uganda and severe locally. *Eleusine* in north-western Ankole was heavily attacked in October by Acridids including *Humbe tenuicornis*, Schaum, *Oedaleus* sp., *Acrotylus* sp., *Paracomacris* sp., *Sumba* sp., *Roduniella* sp. and *Catantops melanostictus*, Schaum. Beetles, including *Lagria villosa*, F., *Coryna apicicornis*, Guér., *Ootheca bennigseni*, Weise, and *O. bifrons*, Laboiss., caused considerable damage to lima beans (*Phaseolus lunatus*) and tepary beans (*P. acutifolius*) in Busoga in May; and in Kigezi in the same month, bean seedlings 2–4 ins. high were attacked by *Dasus* (*Gonocephalum*) *simplex*, F. (which occasionally is a pest of cotton and coffee) and the leaves and flowers by *Haltica* sp., but no serious damage occurred. The roots of pyrethrum [*Chrysanthemum cinerariaefolium*] were injured in Kigezi by Lamellicorn larvae, and tobacco plants with a high nicotine content were slightly damaged in November and December by larvae of *Plusia* (*Phytometra*) *orichalcea*, F. A plot of castor [*Ricinus communis*] at Kawanda was heavily infested in January by nymphs and adults of the Cercopid, *Ptyelus grossus*, F., and some of the plants were defoliated as a result. The introduced weevil, *Gonipterus scutellatus*, Gylh. [*cf.* **36** 106] was collected in January in the Mbale district, where it had apparently been present since 1942 and had defoliated older trees of *Eucalyptus robusta*; young trees were only slightly attacked.

Maize stored in bags in corrugated iron sheds throughout Buganda was found in January–February to be heavily infested by insects. *Calandra oryzae*, L., was the principal primary pest, though larvae of *Sitotroga cerealella*, Ol., and *Corcyra cephalonica*, Staint., were also present and of importance in some cases; secondary pests feeding on the broken grains were *Tribolium castaneum*, Hbst., *Carpophilus dimidiatus*, F., *Laemophloeus* sp. and *Tenebroides mauritanicus*, L. A rough survey in two districts indicated that populations of *Calandra oryzae* averaged about 250,000 adults per ton and that over 50 per cent. of the grains were attacked; there were 1,000,000 adults per ton in a store in another district, and up to 10 per cent. by weight of the grain was destroyed. Parasitism by Pteromalids, Encyrtids and Braconids was heavy. Dried cassava roots in one store were severely damaged by *C. oryzae*, *Xyloperthodes* sp., an unidentified Bostrychid and *Araecerus* sp., and *Gnathocerus cornutus*, F., *Tribolium castaneum* and *Laemophloeus* sp. were feeding in the tunnels made by them. Stored soy beans were heavily infested by *Bruchus analis*, F., apparently because they had a high moisture content, which made them susceptible to it, and dried salt fish was attacked by *Necrobia rufipes*, Deg., and *Dermestes maculatus*, Deg. (*vulpinus*, F.).

GADD (C. H.). **Report of the Entomologist for 1945.**—*Bull. Tea Res. Inst. Ceylon* no. 27 pp. 30–36. Talawakelle [1946].

Agromyza (*Melanagromyza*) *theae*, de Meij. [*cf. R.A.E.*, A **30** 319], which frequently mines the leaves of tea in Ceylon but is not a major pest, was unusually abundant at St. Coombs in August 1945, but had disappeared by the end of October. A small collection of pupae of this Agromyzid was heavily parasitised; the commonest parasite was *Closterocerus insignis*, Wtstn., but small numbers of *Trigonogastra* sp. and an undetermined Braconid also emerged. All of 41 larvae pupated normally in the laboratory, but only six pupae completed their development; the Braconid emerged from 27 of the others, 14–23 days after the host larvae had pupated. It is concluded that *A. theae* is normally effectively controlled by parasites. Its eggs are placed singly beneath the epidermis of the upper surface of the leaves; generally only two are laid in the same leaf, though there may occasionally be as many as five. The second and third leaves from the bud are preferred, and the youngest leaves avoided. The larvae construct irregular galleries beneath the upper epidermis and pupate in them; the larval and pupal stages lasted 11 and 14–16 days, respectively.

Observations on damage by the tea shot-hole borer [*Xyleborus fornicatus*, Eichh. (*cf.* **36** 251)] on tea bushes in manured plots at Passara were continued during the year, which was the second of the current pruning cycle [*cf.* **35** 2, etc.], and the mean numbers of broken branches per collection for each month of 1945 and also for 1942, the corresponding year of the preceding cycle, are shown in a table. Broken branches were again most numerous in June–July [*cf.* **32** 306], thereby supporting the previous conclusion that maximum damage occurs towards the end of the second year from pruning, although in the current cycle the plots were manured 12 and 25 months after pruning instead of 6, 19 and 30 months after pruning as in the previous one. Further evidence that factors other than date of manuring influence damage was obtained from one plot that received the same treatment as the others, but in which breakages were most numerous in October 1944 and more numerous than in the other plots [**35** 2] until July 1945. After this, no difference was noted. The numbers of broken branches were smaller in 1945 than in 1942, but this is not thought to be connected with the change in the date of manuring. The observation plots were suitable for attack in 1944 and were next to others that had been pruned a year earlier and in which populations were therefore likely to be at their maximum. However, there was no indication of any mass migration from the latter, and it is concluded that the observed reduction in damage and, by inference, in population during the third year is not due to migration away from the plants. By using a recently developed rearing method by which eggs can be incubated and pupae brought to maturity under continuous observation, the duration of these stages was found to be seven and eight days, respectively [*cf.* **30** 232].

Tipulid larvae that were subsequently shown to be *Pales* (*Pachyrhina*) sp. and were stated to have damaged young tea plants in a nursery bed were received at the laboratory when nearly fully fed and placed in pots with growing seedlings of tea and other plants. They pupated after about 15 days, and adult males and females emerged 6–7 and 7–8 days later, respectively; the adults survived for 6–13 days and mated under laboratory conditions, but no eggs were laid. The roots of the seedlings were examined after the emergence of the adults and found to be undamaged. There is one record of this Tipulid as a pest of vegetables, but it had not hitherto been reported in tea nurseries.

Brevipalpus (*Tenuipalpus*) *obovatus*, Donn., is probably the most important mite that attacks tea in Ceylon, since severe infestation causes defoliation and

in some areas occurs regularly. Counts were made of mites and eggs on samples of 40 mature leaves taken from plants of one clone at regular intervals from the middle of February, when the mites appeared on the plants, until the end of the year. The numbers of mites per sample increased during the dry months from 400 in February to 1,300 by the middle of April, but were still not great enough to result in appreciable damage. At the end of May, they had decreased to 160, and after that rarely exceeded 30 until November, when they began very slowly to increase.

The mite recorded [as *Tetranychus* sp.] defoliating *Albizzia* in 1944 [**35** 3] has been identified as *Tydeus womersleyi*, Thor ; it was common on defoliated *Albizzia* on two other estates during 1945.

Some of the larvae of *Pales* sp. were used in the laboratory to test the value of Gammexane against soil pests. Gammexane is the registered trade name of an insecticide [containing benzene hexachloride] and was diluted 1 : 19 with saphos-phosphate for use. Five containers each with 300 gm. soil and 30 larvae were set up and a small heap of a bait consisting of bran alone, bran and Paris green (25 : 1), bran and the Gammexane mixture or about 0·5 gm. of the latter alone was placed on the surface near the middle. The baits were removed daily and the soil examined for dead and moribund larvae, after which the baits were replaced. This proved difficult with the Gammexane alone, so after the second day, when 13 moribund larvae had been found, it was mixed with the soil. After five days, 14 and 30 moribund larvae had been found in the containers treated with Gammexane with and without bran, respectively, as compared with insignificant numbers in the others. It is concluded that baits are ineffective against these larvae and that Gammexane acted as other than a stomach insecticide. Larvae affected by it were usually found on the surface of the soil, with a swelling at the head end, and of the 17 that were removed on the third day and kept with untreated soil for a further week, six died, one pupated and the rest remained immobile. In another test, 0·013–1·6 gm. of the Gammexane mixture was incorporated with 20 gm. soil in tubes and 10 larvae added. On the following day, larvae with swollen heads were found on the surface of the soil treated with 0·025–0·4 gm. The larvae from all the tubes were then transferred to the surface of untreated soil, and all except those from untreated soil and soil treated with 0·013 gm. and three from soil treated with 0·025 gm. remained on the surface ; none of the affected larvae recovered, and many died within a week. On this basis, crude Gammexane at a rate of about 24 lb. per acre would render the soil toxic to a depth of 1 in., but its use is not recommended until more is known of its effect on other soil animals.

Insects and their Control.—*58th Rep. S. Carolina Exp. Sta.* 1944–45 pp. 57–65. Clemson, S.C., 1946.

An account of work on the control of various insect pests in South Carolina in 1944–45 is given by D. Dunavan. In December 1944, dry maize and cowpeas were thoroughly mixed with various amounts of dusts containing 3 per cent. DDT or 0·5 or 4·4 per cent. rotenone and stored in sacks, and the maize was artificially infested with *Calandra* (*Sitophilus*) *oryzae*, L., in April 1945. On examination in October 1945, the maize treated with the DDT dust at $\frac{1}{8}$ oz. per peck was found to be undamaged, and that treated at $\frac{1}{4}$ or $\frac{1}{2}$ oz. per peck was slightly damaged but contained no living weevils, whereas maize that was untreated or treated with the rotenone dusts at $\frac{1}{8}$–$\frac{1}{2}$ oz. per peck was severely damaged and about half of it destroyed. There was considerable webbing, apparently due to *Pyroderces rileyi*, Wlsm., in the sack treated with $\frac{1}{2}$ oz. 4·4 per cent. rotenone. All the dusts at 2 oz. per bushel completely protected the cowpeas against *Bruchus* (*Callosobruchus*) *maculatus*, F., whereas untreated cowpeas were completely riddled.

In field tests against the cowpea curculio [*Chalcodermus aeneus*, Boh.], dusts of sabadilla, DDT with 1 per cent. petroleum oil or 5 per cent. DDT were applied to cowpeas in early morning at intervals of 4 or 5 days, beginning when the pods began to form and ending when all the pods had been picked. Some difficulty was experienced with the DDT-oil dust, which tended to cake and was rather heavy. The average numbers of larvae per gm. that emerged from pods of cowpeas planted on 23rd May were 0·74 for sabadilla, 0·78 for DDT with oil and 0·82 for 5 per cent. DDT, as compared with 1·14 for no treatment ; the corresponding figures for cowpeas planted on 12th June, which gave considerably higher yields, were 0·31, 0·35, 0·57 and 0·62.

In tests in 1945 for the control of *Heliothis armigera*, Hb. (*obsoleta*, F.), on sweet maize, a 2 per cent. solution of styrene dibromide in light mineral oil, about 20 drops of which were applied to each ear with a pipette when the silks were beginning to turn brown, was compared with dusts of lead arsenate and 3 per cent. DDT, applied to the silks at intervals of about two days from the time the silks appeared until the ears were harvested. The percentages of undamaged ears were 52·1 for styrene dibromide, 8·49 for lead arsenate and 22·22 for DDT, as compared with 0 for no treatment. There was some indication that styrene dibromide prevented proper filling of the kernels when it was applied too soon after the silks developed, but it is thought to show promise, since ears treated with it are seldom seriously injured by *H. armigera*. The DDT was less effective than it had been in 1944 [*cf. R.A.E.*, A **34** 355]. In August 1945, when the tops of the stalks of sweet maize that had not tasselled were so severely damaged by *H. armigera* that its survival seemed doubtful, two applications at an interval of six days of a dust of undiluted lead arsenate gave complete control ; the tassels developed normally, and only slight scorching appeared as the leaves unfurled.

Numerous eggs of *Anasa tristis*, Deg., were deposited on summer squashes dusted at intervals of about three days from 9th June to 14th July with 3 per cent. DDT, but only a few bugs were present at any time and damage was slight. The plants were still healthy and bearing well long after untreated plants had been killed by the attack, and no damage to the plants by DDT was noticed.

In August, dusts of sabadilla, rotenone, cryolite and 3 per cent. DDT were applied to snap beans for the control of *Epilachna varivestis*, Muls. After the third dusting, the cryolite row was almost uninjured, while plants treated with the other dusts were as badly damaged as the controls. It is not known whether cryolite is safe for general use, because of possible poisonous residues on the beans. Repeated dusting of lima beans with sabadilla resulted in no appreciable control of *E. varivestis*.

F. Sherman (p. 61) reports that work on the introduction of *Macrocentrus ancylivorus*, Rohw., for the control of the oriental fruit moth [*Cydia molesta*, Busck] on peach [*cf.* **30** 42, etc.] was continued ; it was liberated in seven orchards in five counties in June. Observations indicate that a build-up of this parasite and of the native *M. delicatus*, Cress., is taking place.

Bondy (F. F.) & Rainwater (C. F.). **Cotton Insect Investigations.**—*58th Rep. S. Carolina Exp. Sta. 1944–45* pp. 101–105. Clemson, S.C., 1946.

Field experiments over several years on the control of the boll weevil [*Anthonomus grandis*, Boh.] on cotton in South Carolina have shown that mopping at the pre-square stage with a mixture of calcium arsenate, molasses and water (1 : 1 : 1) reduces the early weevil population and effects some degree of control [*cf. R.A.E.*, A **31** 188], but as the time for effective mopping is usually over before the hibernating weevils have completed their emergence,

this method has not proved satisfactory in years of heavy weevil damage. Dusting with calcium arsenate has resulted in far greater increases in yield than mopping, and mopping followed by dusting has resulted in only slightly greater yields than dusting alone [*cf. loc. cit.*]. Unlike calcium-arsenate dust, mopping has not caused a noticeable increase in the cotton Aphid [*Aphis gossypii*, Glov.]. The addition of 1 per cent. nicotine to calcium arsenate or of 0·75 per cent. rotenone to calcium arsenate or basic copper arsenate has prevented *A. gossypii* from developing to injurious numbers [*cf.* **34** 356], and given more satisfactory results than higher dosages of nicotine applied after heavy populations have been built up. Basic copper arsenate has proved a fairly effective substitute for calcium arsenate against *Anthonomus*, but DDT, tested in 1945, was not effective against either the weevil or the Aphid when used as a 10 per cent. dust in pyrophyllite, a 5 per cent. dust with calcium arsenate or basic copper arsenate or with mixtures of either of these materials with rotenone or nicotine, or in sprays containing 2 or 4 lb. 40 per cent. water-dispersible DDT per 50 U.S. gals. water.

Observations made by means of hibernation cages, by collecting hibernating weevils from surface trash and by means of trap crops have shown that temperature is the most important factor in determining the survival of *A. grandis* in winter [*cf.* **31** 187], but humidity has the greatest influence on emergence in spring. Emergence is late in dry springs, regardless of temperature, and early, wet springs seem to extend the period of emergence, although larger percentages of the weevils emerge early. The percentage of total emergence between 15th and 30th June has ranged from 42 in 1943 to 19 in 1945, with an average of 38 for the period 1938–45. The emergence of more than 33 per cent. of the weevils after 15th June, when the early squares are large enough for oviposition, assures the development of damaging infestations in favourable seasons and largely explains why pre-square poisoning does not give effective control.

When the oxides of various metals were added to calcium arsenate to prevent injury to plants growing in light, sandy soil containing it [*cf.* **34** 355], 5 per cent. by weight of the oxides of iron, copper, lead and zinc showed corrective tendencies, which were more pronounced in the second year following heavy applications (500 lb. per acre) of the mixture than in the first year. The oxides of magnesium and manganese had little or no corrective effect.

ALLEN (N.). **Experiments with DDT for Tobacco Insect Control.**—*58th Rep. S. Carolina Exp. Sta. 1944–45* pp. 108–113. Clemson, S.C., 1946.

Tests carried out in 1944 on the control of *Protoparce sexta*, Joh., on tobacco in South Carolina showed that a powder containing 10 per cent. technical DDT in pyrophyllite was unsatisfactory when applied as a dust or a spray [*R.A.E.*, A **34** 356]. In further tests in 1945, the materials used were a water-dispersible powder containing 40 per cent. DDT and a dust mixture containing 25 per cent. DDT in pyrophyllite. When sprays containing 1, 2, 2½ or 3 lb. of the powder per 50 U.S. gals. were compared in small-plot tests, the greatest reduction in numbers of larvae was given by the strongest spray, but it was not so effective as sprays containing 4 lb. lead arsenate or 6 lb. basic copper arsenate. The dust was applied throughout the season, and four applications made between 8th June and 30th July at rates of 15–24 lb. per acre each appreciably reduced the numbers of larvae in 5–6 days but did not prevent the larvae from reappearing on the plants. In an experiment in August on a farm where large tobacco plants were infested at the average rate of 3·2 larvae per plant, the 25 per cent. dust and the 40 per cent. dispersible powder were each applied once, the former at the rate of 40 lb. (10 lb. actual DDT) per acre and the latter as a spray at

6 lb. per 50 U.S. gals. and about 75 U.S. gals. (3·6 lb. actual DDT) per acre. Four days after application, both treatments had given excellent control; many of the large larvae had left the plants and died on or between the rows. In view of the high concentrations and dosages required, however, the use of DDT for control of *Protoparce* is considered uneconomic.

In tests against the tobacco budworm [*Heliothis virescens*, F.] in 1944, three applications of a 10 per cent. DDT dust, the first early in the season at an average rate of 7 lb. per acre and the others at average rates of 18 and 19 lb. per acre, gave good control by 1st July, although no special effort had been made to introduce the insecticide into the buds of the plants. A count on 6th July showed that only 1·6 per cent. of the plants had been attacked, as compared with 3·6 and 2·2 per cent. in two neighbouring fields that had received two applications of the standard budworm bait of lead arsenate and maize meal. The dust was then applied by different methods to the buds of lots of 75 plants, each of which was considered to contain one larva. The numbers of living larvae found four days after treatment were 4 when the dust was applied by hand at 7·5 lb. per acre, 0 when it was applied by means of a shaker bottle at 9 lb. per acre, 8 when it was applied by plunger duster at 5 lb. per acre and 9 when it was applied by rotary hand gun at 15 lb. Either of the first two methods should be practicable for farmers. Fields dusted with 10 per cent. DDT in 1944 and 25 per cent. DDT in 1945 showed very little damage by *Epitrix hirtipennis*, Melsh., whereas neighbouring undusted plants were attacked. In view of these results, it is suggested that small quantities of DDT added to sprays of basic copper arsenate, lead arsenate or cryolite used primarily against *P. sexta* might control *H. virescens* and *E. hirtipennis* at reasonable cost.

In late May and early June 1945, a tree cricket, *Oecanthus nigricornis*, Wlk., appeared in injurious numbers in one of the test fields and was abundant on plants that had been dusted twice with 25 per cent. DDT. A count on 6th June showed that 14·7 per cent. of the plants had been injured. An application of the 25 per cent. dust at 19 lb. per acre killed most of the Gryllids in a few hours, although the residues from the two previous ones had apparently shown no toxicity to them.

HOUGH (W. S.). **Influence of some Spray Ingredients and Dosage of Lead Arsenate on Effectiveness of Lead Arsenate Sprays for Codling Moth Control.**—*Bull. Va agric. Exp. Sta.* no. 388, 11 pp., 2 figs. Blacksburg, Va., 1946.

The results are given of experiments carried out in Virginia mainly in 1943–45 to determine whether the addition of a spreader, adhesive, deposit builder or corrective increased the effectiveness of lead-arsenate cover sprays against the codling moth [*Cydia pomonella*, L.] on apple and what dosage of lead arsenate was necessary for control. In orchard experiments with spreaders and adhesives, the addition of 1 U.S. pint crude soy-bean oil or 1 U.S. quart fish oil to a spray of 3 lb. lead arsenate and 2 lb. lime per 100 U.S. gals. increased the proportion of undamaged fruit considerably, and ½ lb. crude soy-bean phosphatides [*cf. R.A.E.*, A **31** 397] in 2 U.S. quarts kerosene and a number of proprietary materials tested increased it to some extent, whereas ½ lb. soy-bean flour, 3 lb. aluminium hydroxide gel and some other proprietary products decreased it. The use of 20 oz. DN-111 [which contains about 20 per cent. of a dicyclohexylamine salt of 2,4-dinitro-6-cyclohexylphenol] instead of 2 lb. lime in the lead-arsenate spray decreased it considerably; DN-111 was included in these tests because it has been used with lead arsenate to destroy mites and leafhoppers [*cf.* **34** 52, 203, etc.] and also because it had shown promise as a

corrective for arsenical injury. In laboratory tests with sprays containing 4 lb. lead arsenate per 100 U.S. gals., similar results were obtained with several of the materials, including DN-111, but soy-bean flour increased control.

In laboratory tests with correctives, added to the lead-arsenate spray to reduce arsenical injury on the foliage and fruit, the addition of 2, 4 or 10 lb. lime, or ½ lb. zinc sulphate and 2 lb. lime per 100 U.S. gals. or of Bordeaux mixture (½ : 2 : 100 or 2 : 4 : 100) had little effect on toxicity, but 2 U.S. gals. lime-sulphur with 2 lb. lime reduced it in all cases. Similar results were obtained in the field, except that both 10 lb. lime alone and 6 lb. lime with 10 U.S. quarts lime-sulphur reduced toxicity considerably. Comparison of different concentrations of lead arsenate in the sprays showed that increasing the dosage from 3 to 4 and (in 1945) 6 lb. per 100 U.S. gals. improved control, chiefly by preventing superficial injuries, and that reducing it to 2 lb. resulted in increases in the proportion of infested apples. In 1943 and 1944, when conditions were favourable for the moth, a minimum dosage of 4 lb. per 100 U.S. gals. was necessary for fairly satisfactory results, and in 1945, a season unfavourable for the moth, a dosage of 6 lb. per 100 U.S. gals. was slightly more effective than one of 4 lb.

Woodside (A. M.). **Some Insects that cause Cat-facing and Dimpling of Peaches in Virginia.**—*Bull. Va agric. Exp. Sta.* no. 389, 15 pp., 16 figs. Blacksburg, Va., 1946.

The types of injury caused to peach fruits in Virginia by *Euschistus servus*, Say, *E. variolarius*, P. de B., *E. tristigmus*, Say, *Acrosternum hilare*, Say, *Thyanta custator*, F., *Lygus oblineatus*, Say, and *Conotrachelus nenuphar*, Hbst., are described and illustrated, and brief notes are given on the bionomics of some of them [*cf. R.A.E.*, A **35** 248–250] ; *A. hilare* causes dimpling and puckering of the fruits, and the others various types of damage grouped under the name of cat-facing. Clean cultivation of the orchards is suggested for reducing injury by *L. oblineatus*, and it usually reduced injury by *E. servus* and *E. tristigmus*, the most important causes of cat-facing in Virginia. These insects develop on plants other than peach, and *Euschistus* spp. have caused the most severe injury in orchards where crimson clover [*Trifolium incarnatum*] or hairy vetch were used as cover crops [but *cf.* **36** 334]. *E. servus* also feeds on tobacco and tomato, but the preferred food-plant appears to be common mullein [*Verbascum thapsus*], and where there is injury to the fruits, the growth of this weed should be prevented in and near the orchard. Severe injury to peaches by *A. hilare* has been reported from only a few orchards, and in each case the orchard was surrounded by woods or adjacent to an area of forest trees. When injury by this species is observed, trees and shrubs that bear pods or fruit, such as black locust [*Robinia pseudacacia*], honey locust [*Gleditsia triacanthos*] and elder [*Sambucus*] should be removed. *C. nenuphar* usually causes little cat-facing when a regular control programme is followed. This should consist in burning or otherwise cleaning up the rubbish in woods or brush adjacent to the orchard, preferably just before the peach trees flower, jarring the outside rows of peach trees to catch the adults as they enter the orchard, applying three well-timed lead-arsenate sprays, at petal-fall, at sepal fall and one week later, destroying infested dropped fruits, and cultivating the soil to kill the pupae. This cultivation should pulverise the soil thoroughly to a depth of at least 2 ins. and extend as close to the trunks of the trees as possible. Three cultivations, on or about 7th, 14th and 21st June, are necessary in Virginia to kill most of the pupae, but as most orchards are cultivated, this necessitates only the changing of dates.

The losses from cat-facing can be reduced by removal of such injured fruits as can be detected at thinning time. Control of the Pentatomids by spraying has never been very successful, as the adults are resistant to sprays and their

numbers are not reduced by the regular peach spray programme. Even if a spray material were discovered that would kill them, only those that were on the trees at the time of treatment would be destroyed.

UNDERHILL (G. W.) & BODENSTEIN (O. F.). **Edgegrowth as related to Crop Yield and Insect Damage.**—*Tech. Bull. Va agric. Exp. Sta.* no. 97, 18 pp., 3 figs. Blacksburg, Va., 1946.

An account is given of investigations in Virginia in 1942–44 on the possible effects of hedgerows and other plants on the borders of fields in protecting birds and rodents that prey on insects injurious to field crops and in protecting the insects themselves. A field of about 80 acres was selected, with mature woods, bordered with smaller trees and bushes and some briars, to the north-west; two areas in it were planted with black locust [*Robinia pseudacacia*], and species of *Lespedeza* were planted thinly along these and along part of the edge of the field next the wood. Wheat and barley were sown in the field in the autumn of 1941, clover and timothy grass [*Phleum pratense*] were drilled in the wheat in the spring of 1942, and maize was planted in half the field in 1944. Observations on maize were also made in other fields in 1942 and 1943.

The following is largely based on the authors' summary. In 1942, 1943 and 1944, uniform collections of insects were made at different points at intervals of 4–6 weeks from March to September. There were variations in the numbers of insects collected in the selected areas for certain periods in the season and even in the numbers of some families and related groups of injurious insects, but the differences did not depend on the relation of the point of collection to the woods or border plantings. Data on the yield of hay were collected at several points in 1943, but statistical analysis showed no difference that could not be accounted for by chance. The edge growth had no effect on the infestation of maize in 1944; injury to young maize was light at all the observation points, and the amount of injury to the mature crop and the yield did not show any variations due to proximity to it. Insect injury to maize was unimportant in all three seasons.

The three varieties of *Lespedeza* used were attacked by relatively few kinds and numbers of insects. None of the insects appeared to be of much economic importance except two species of *Alydus* that congregated on the seeds in autumn and might be potentially dangerous to leguminous crops if the *Lespedeza* border existed for several years. On the whole, the *Lespedeza* plants seemed very suitable for a border crop in this field.

CAGLE (L. R.). **Life History of the European Red Mite.**—*Tech. Bull. Va agric. Exp. Sta.* no. 98, 19 pp., 7 figs,, 4 refs. Blacksburg, Va., 1946.

Paratetranychus pilosus, C. & F., all stages of which are briefly described, is a serious pest of apple in Virginia, and a study of its life-history was made in the insectary at Blacksburg in 1943 and 1944. The mites were reared on sections of apple leaf on twigs standing in water. Only one leaf was left on each twig, and it was cut back to $\frac{3}{4}$ inch and inserted through a slit cut along the middle of a strip of celluloid, which confined the mites on it. To obtain winter eggs, a celluloid collar round the twig was substituted for the celluloid clip on the leaf, and a celluloid cell clipped on the leaf was used for individual study of adults.

The following is based on the author's summary. The hatching of the winter eggs began when apple buds were beginning to show pink and continued until the petals were falling. In 1944, the first winter eggs were deposited by females that emerged on 28th August. In that year, nine generations were reared; some eggs of the tenth generation hatched, but none of the mites reached

maturity. Summer eggs were deposited from about 10th May until 30th September in 1943 and from 4th May until 27th September in 1944, and the last eggs hatched on 19th October in 1943 and on 8th October in 1944. The incubation period ranged from five days at average temperatures of 76·1°F. in 1943 and 75·2° in 1944 to 20 days at 55·8°F. in 1943, and the larval, protonymphal and deutonymphal periods were 1–7, 1–8 and 1–9 days, respectively. The periods for development from hatching to adult were 4–19 days for males and 4–22 days for females. The preoviposition period was 1–17 days, averaging 2·3 days in 1943 and 2·4 days in 1944. The maximum oviposition period was 25 days, and the average for 45 females in 1944 was 12·4 days. The greatest number of eggs deposited by a female was 69, and the average for 45 females was 18·8. The length of life of females varied from five to 39 days and averaged 18·8 days. All mites reared from the eggs of unfertilised females and 37·2 per cent. of those from the eggs of females allowed to pair were males.

GUNN (D. L.) & others. **Mass Departure of Locust Swarms in Relation to Temperature.**—*Nature* **156** no. 3969 pp. 628–629. London, 1945.

If it is planned to destroy a swarm of adult locusts by an insecticide applied from aircraft before they take flight in the morning, it is important to know the length of time available for application. The behaviour of swarms of *Schistocerca gregaria*, Forsk., on the ground was therefore investigated in Kenya ; a nearly mature swarm was studied on ten days between 25th April and 11th May 1945, and two immature swarms on 23rd March and 4th April. Continuous observations on meteorological conditions were made on each occasion, and about 70 measurements of the body temperatures of the locusts were made each hour by means of a thermocouple inside a hypodermic needle inserted along the abdomen into the thorax. It was found that the air temperature at the time of mass departure varied only between 19°C. [66·2°F.] and 23°C. [73·4°F.], but that the body temperatures of individual locusts at such times ranged from 21 to 38·3°C. [69·8 to 100·94°F.] and varied considerably in locusts from different microclimates. Locusts will not fly when the body temperature is too low, but once it has become high enough, mass departure appears to take place as a reaction to air temperature. Further observations on an immature swarm at a higher air humidity supported this conclusion ; the air temperature at which mass departure occurred in this case varied from 17°C. [62·6°F.] to 19°C. There is also evidence that the settling of a swarm in the evening is correlated quite closely with air temperature.

GOVAERTS (J.) & LECLERCQ (J.). **Water Exchange between Insects and Air Moisture.**—*Nature* **157** no. 3989 p. 483, 6 refs. London, 1946.

It is known that the weight of some insects, such as *Leptinotarsa decemlineata*, Say, *Chortophaga viridifasciata*, Deg., *Cimex lectularius*, L., and larvae of *Tenebrio molitor*, L., increases when they are exposed while fasting to an atmosphere saturated with water vapour. This increase is attributed to absorption of moisture from the air, and such insects have been called " hygroscopic." In order to isolate the factor of " hygroscopicity," the effect was investigated of keeping insects in air saturated with water vapour that contained 8 per cent. heavy water. The insects used were adults of *T. molitor* and *Graphosoma lineatum*, L., both of which lost weight during the experiment, and larvae of *T. molitor* and adults of *L. decemlineata*, both of which gained weight. It was found that the body water of all these insects eventually contained 8 per cent. heavy water, and that this equilibrium was attained in 13 days in larvae of *T. molitor*, nine days in adults of *T. molitor* and *L. decemlineata*, and five days in adults of *G. lineatum*. It is therefore concluded that under the conditions

studied there is a continuous exchange between the atmospheric water vapour and the body water of the insects, and that the latter is completely replaced by water molecules from the atmosphere within a few days.

PRENTICE (I. W.). **Resolution and Synthesis of Virus Complexes causing Strawberry Yellow-edge.**—*Nature* **158** no. 4001 pp. 24–25, 2 refs. London, 1946.

Preliminary tests in England [*R.A.E.*, A **35** 207] have shown that *Capitophorus fragariae*, Theo., transmits a single virus, believed to be that of mild crinkle, after feeding for 24 hours on strawberry plants infected with yellow-edge, and C. A. Wood & T. Whitehead, working in Wales, have found that two viruses, one of which is more persistent than the other, can be isolated from plants infected with severe crinkle. The author has since shown that a persistent virus, apparently distinct from the persistent virus of Wood & Whitehead, can be isolated from plants infected with yellow-edge. In experiments with this virus, examples of *C. fragariae* that had fed for ten days on a Royal Sovereign strawberry plant infected with yellow-edge were allowed to feed on uninfected plants of wild strawberry for 24 hours and were then transferred to other uninfected plants of wild strawberry. These last did not become infected with the non-persistent mild-crinkle virus, but some of them developed a chlorotic spotting that was often accompanied by slight cupping of the leaves. The virus causing these symptoms was transmitted after feeding periods of 24 hours or more on the infected plants, persisted in the vector for several days, and produced very mild and scarcely discernible symptoms of the yellow-edge type on Royal Sovereign plants ; it is provisionally designated as the mild yellow-edge virus. When a Royal Sovereign plant infected with either this or the mild-crinkle virus is grafted on to a plant infected with the other, it develops severe symptoms of yellow-edge.

A persistent virus, probably identical with the one isolated by Wood & Whitehead, was also isolated from plants infected with severe crinkle ; it was transmitted by *C. fragariae* after a feeding period of ten days on the infected plants, persisted in the vector for several days, and produced symptoms of the severe-crinkle type in healthy Royal Sovereign plants. When combined with the mild yellow-edge virus, it produced severe yellow-edge.

Yellow-edge was thus produced by the mild yellow-edge virus in combination with the virus of either the mild or the severe crinkle type. The occurrence of crinkle in association with yellow-edge had frequently been observed in grafting experiments, but the obligate nature of the association had not hitherto been demonstrated.

MCINTOSH (A. H.). **Relation of Crystal Size and Shape to contact Toxicity of D.D.T. Suspensions.**—*Nature* **158** no. 4012 p. 417, 3 refs. London, 1946.

The toxicity of many insecticidal suspensions or emulsions in which the toxic compound constitutes part or all of the disperse phase varies inversely with the particle size of this phase. The experiments described, however, indicate that this relationship is reversed in aqueous suspensions of pure p,p'DDT. Crystals of p,p'DDT are normally needle-shaped, but in certain circumstances they are in the form of plates. Suspensions made of crystals of six different types varying from colloidal DDT to needle-shaped crystals 350μ in length were tested against *Tribolium castaneum*, Hbst., chiefly by means of a dipping technique recently developed by the author. It was found that toxicity is associated primarily with the over-all length of the crystals, with which it varies directly, and that an increase in their breadth is accompanied by some decrease in toxicity. The ratio of the median lethal doses of the extreme sizes tested

was of the order of 12 : 1, but it is unlikely that the highest toxicity obtained represents the true maximum. Similar results were obtained when the suspensions were applied by means of a Potter spraying apparatus [*R.A.E.*, A **29** 591]. The results conform with a previous conclusion that the increase in toxicity to house-flies [*Musca domestica*, L.] with time shown by residual films of DDT is related to slow crystallisation of DDT from a gum-like residue of low toxicity [B **34** 122]. It is suggested that large particles may be more easily retained on the insects by irregularities of the cuticle surface than small ones, and that the higher toxicity of suspensions containing them may thus be due in effect to a higher dosage of the toxic element.

Markham (R.) & Smith (K. M.). **A new crystalline Plant Virus.**—*Nature* **157** no. 3984 p. 300, 2 figs. London, 1946.

Smith (K. M.) & Markham (R.). **An Insect Vector of the Turnip Yellow Mosaic Virus.**—*Op. cit.* **158** no. 4012, p. 417, 1 ref. 1946.

In the first paper, the finding of a new virus that affects turnips in Britain is recorded, and the symptoms it causes in turnip and Chinese cabbage, the method by which it was isolated from the latter in crystalline form, and the crystals are described. It is named turnip yellow mosaic virus. Unlike the other crucifer viruses, it was in high concentration in the plant and was infectious at dilutions of 1×10^{-5}, and, like viruses that occur at high concentration in plants, it was not insect-borne.

It is stated in the second paper that the insects with which negative transmission experiments were carried out were Aphids. Insect transmission would be expected, however, since turnip is an annual crop, and subsequent observations on a small plot of turnips sown out of doors and containing a few infected plants placed at random indicated that insect transmission was taking place. As the only insects present in any numbers were Aphids and *Phyllotreta* spp., tests were made with the latter. Two insect-proof cubicles in a glasshouse were filled with healthy young plants of turnip and Chinese cabbage, two infected plants were placed in each, and a large number of adults of *Phyllotreta* spp., mostly *P. cruciferae*, Goeze, and *P. vittula*, Redt., were introduced into one. Nine plants in this cubicle showed symptoms of the disease 10–13 days later, and no plants became infected in the control cubicle. It therefore appears that the disease is transmitted by *Phyllotreta*, and this constitutes the first instance of virus transmission by a biting insect recorded in Britain.

Newton (H. C. F.), Satchell (J. E.) & Shaw (M. W.). **Carrot Fly Control.**—*Nature* **158** no. 4012 p. 417. London, 1946.

The application of mercurous chloride (calomel) to the plant rows is ineffective against the carrot fly [*Psila rosae*, F.], and DDT and benzene hexachloride differed greatly in effectiveness when tested for its control in England in 1945. A dust containing enough crude benzene hexachloride to give 0·25 per cent. γ isomer increased the percentage of undamaged roots from 12·7 for no treatment to 99·7, and the damaged roots were only slightly attacked. A dust containing 5 per cent. DDT gave 44·2 per cent. undamaged roots, 21 per cent. slightly damaged and 25·5 per cent. unmarketable ; 56·7 per cent. of the roots from control rows were unmarketable. Similar results were obtained in 1946 up to the time of writing. The reason for the difference in the effectiveness of the two insecticides is not known ; protection followed the limits of distribution of the dust very closely, and it is therefore unlikely that the benzene hexachloride exerted any repellent effect. Moderate applications of this material cause serious injury to the stems of crucifers at the point of contact, but even unnecessarily heavy applications did not damage carrot plants.

TAYLOR (H.) & FRODSHAM (J.). **Assay of Toxic Effect of " Gammexane " on Man and Animals.**—*Nature* **158** no. 4016 p. 558, 3 refs. London, 1946.

As little information is available regarding the toxicity of benzene hexachloride to man and animals, the possibility of chronic poisoning or of cumulative toxic effects from residues left on foodstuffs was investigated. The addition to the diet of rats each day for 27 days of 10, 20 or 30 mg. pure γ isomer in powder form per kg. body-weight produced no effect. Further experiments were made with benzene hexachloride containing 13 per cent. γ isomer, the form commonly used in commercial insecticide preparations. The median lethal dose to rats is 1,250 mg. per kg. body-weight, but when 500 mg. per kg. was added each day for 57 days to the normal diet of five half-grown rats, their rate of growth was the same as that of untreated litter-mates, they developed no toxic symptoms, and at the end of the period their internal organs were all normal. In a similar experiment, rats that received a daily dose of 500 mg. pure DDT powder per kg. showed nervous symptoms within two days, but such symptoms appeared only occasionally in others that received 350 mg. DDT per kg. daily for 48 days ; they grew more slowly than untreated rats, but their internal organs remained normal. Oil was not used to incorporate the DDT powder into the diet.

SWEETMAN (H. L.). **The residual Toxicity of DDT. Influence of Moisture and Temperature on the residual Kill of DDT.**—*Soap & sanit. Chem.* **21** no. 12 pp. 141, 143, 145, 147, 149, 171, 25 refs. New York, N.Y., 1945.

Although DDT is chemically fairly stable under the conditions at which it is usually applied, there is some evidence that deposits retain their toxicity longer indoors than when exposed to the full effects of temperature, moisture and light. Laboratory experiments were therefore carried out to evaluate the influence of temperature and moisture on the duration of toxicity. The tests were made against *Periplaneta americana*, L., *Lepisma saccharina*, L., and *Thermobia domestica*, Pack., in a basement in which no direct sunlight was received and indirect sunlight and artificial light were relatively low in intensity. For testing against *Thermobia*, DDT dust was applied to petri dishes and exposed for periods of up to 70 days to temperatures of 5–37°C. [41–98·6°F.] and relative humidities of 26–82 per cent., after which the insects were put into the dishes and kept in the environment at which the dust had been exposed, except when this involved temperatures of 8°C. [46·4°F.] or less. At these temperatures, *T. domestica* is inactive and would die in a few hours, so the dishes were removed to an environment with a temperature of 23°C. [73·4°F.] and 26 per cent. relative humidity. Low humidity is unfavourable to *T. domestica*, and its ill effects became apparent after a week. Paralysis and death following exposure to DDT occurred in less than a week.

Experiments with a 3 per cent. DDT dust against *T. domestica* showed that exposure for up to 60 days to high temperature and relative humidity consistently reduced the duration of toxicity of the deposit. Dusts exposed at 32–37°C. [89·6–98·6°F.] and high relative humidity (68–82 per cent.), which are optimum for the insect [*cf. R.A.E.*, A **29** 420], caused the lowest average mortalities (49–62 per cent.). Dusts exposed in a dry environment (30 per cent. humidity) at 32°C. and at all lower temperatures regardless of humidity gave kills of 90 per cent. and over. These results, together with those obtained with the cockroaches, which are noticed elsewhere [B **36** 186], suggest that high temperature, and also high relative humidity, at least in combination with high temperature (32–37°C.), have a deleterious effect on the lasting properties of toxic residues of DDT. As these physical conditions are within the normal range to which insecticides are exposed after application, environmental

conditions can be expected to influence the toxicity of DDT deposits in practice. Similar variations in temperature and moisture had no apparent effect on the toxicity to *T. domestica* of a 10 per cent. DDT dust over periods of 22–40 days, complete kill being obtained in all cases. A further test was carried out against the same species using DDT at concentrations of 3, 5, 10 and 100 per cent. after exposures of 5–70 days at 37°C. and 68 per cent. relative humidity. The toxicity of the two lower concentrations declined gradually in this environment, but the higher concentrations continued to give a total kill in almost every case. As it has been reported that dilute DDT is more effective than the undiluted compound, the times required for the various concentrations to produce paralysis and death are given. They vary inversely with the concentrations.

In view of the part played by moisture in reducing the toxicity of DDT deposits, experiments were carried out by the same technique to discover whether it had a similar effect on the toxicity of other insecticidal dusts. Dusts containing 3 per cent. DDT, 95 per cent. sodium fluoride, or pyrethrins in pyrophyllite were compared with an inert material (talc) against *L. saccharina* after exposure for 0–30 days at 23°C. and 82 or 26 per cent. relative humidity. DDT and sodium fluoride gave total kills in all the tests in both environments, and the latter did not cake in the moist atmosphere. Talc was ineffective at the high humidity but gave a high mortality in the dry environment, and the pyrethrum dust was also considerably more effective in the dry atmosphere. It was not fresh, and the carrier may have been more lethal than the insecticide. A dry environment is detrimental to *L. saccharina*, but the mortality under test is thought to have been produced by the insecticides rather than by the low humidity, since the shortest period of survival among the controls was about equal to the longest among the treated insects.

Telford (H. S.). **DDT Toxicity.**—*Soap & sanit. Chem.* **21** no. 12 pp. 161, 163, 167, 169, 2 refs. New York, N.Y., 1945.

An account is given of tests carried out to determine the toxicity of milk, cream and butter from goats that had received oral doses of DDT [*cf. R.A.E.*, B **35** 193]. One goat given a dose of 1·25 gm. DDT per lb. body-weight in maize-starch suspension became prostrate within 52 hours and was destroyed. In the interval, it was milked four times and white rats were allowed to consume as much as they wanted of the milk from one milking. Three of the four rats showed no symptoms, but the one that fed at the third milking showed symptoms after 24 hours and died after 96. Another goat was then given a dose of 0·68 gm. DDT per lb. body-weight and its milk tested similarly. The milk became lethal to the rats 29 hours after the administration of the DDT and remained so for nearly a week. The goat showed severe tremors but recovered. In a comparison of the toxicity to rats of cream and skimmed milk from another goat that had received 0·68 gm. per lb. body-weight, relatively small amounts of cream produced severe symptoms in most cases, while large amounts of skimmed milk were needed to bring about even mild symptoms.

Large numbers of house-flies [*Musca domestica*, L.] were introduced into two cages, one containing milk from a goat that had received 1 gm. DDT per 8–9 lb. body-weight daily for 13 days, the other milk from untreated goats. The flies in the first cage began to show paralysis in less than an hour. Some were down in 1½ hours and all in 2½ hours; none recovered. Flies in the control cage behaved normally and lived for the usual time. When house-flies were subjected to sprays in which were incorporated different proportions of butter from untreated goats or from two goats that had received 1 gm.

DDT per 8–9 lb. body-weight daily for two weeks and 1 gm. per 3·6 lb. body-weight 48 hours before milking, respectively, the sprays that included butter from the treated goats were significantly more toxic than the others, giving percentage mortalities in 24 hours of 20–64·7, as compared with 2–6. It was calculated that the butter must have contained 0·125–0·25 per cent. DDT.

POTTER (C.) & GILLHAM (E. M.). **Effects of atmospheric Environment, before and after Treatment, on the Toxicity to Insects of contact Poisons. I.—** *Ann. appl. Biol.* **33** no. 2 pp. 142–159, 7 figs., 16 refs. London, 1946.

The lack of complete knowledge of factors that affect the toxicity of poisons to insects makes it impossible to determine the extent to which the results of an experiment apply only to the conditions under which it was performed. During work on activators for pyrethrins, it was found that a given substance would show an activating effect in one experiment and not in another, and this was attributed to variations in such conditions as temperature and humidity. Two tests with pyrethrins indicated that although differing conditions did not necessarily influence activating effect, they clearly affected toxicity ; work by other investigators on the effect of temperature and humidity on toxicity of insecticides is reviewed from the literature. Further experiments, which are described in this paper, were accordingly carried out with several insecticides to determine whether this effect was specific to pyrethrins. Adults of *Tribolium castaneum*, Hbst., were sprayed with pyrethrins (alone or activated with terpineol), lauryl thiocyanate or nicotine, all in aqueous media, dinitro-o-cresol in ethylene glycol, DDT in a non-volatile petroleum oil and the oil alone, in an apparatus previously described [*R.A.E.*, A **29** 591] and subjected to warm and cool conditions before and after spraying. These were a temperature of 80°F. and approximately 60 per cent. relative humidity (the conditions at which the insects had been kept) and about 55°F. for one hour prior to spraying and about 60°F. and variable humidity after it. Humidity was not controlled, but the evidence indicated that within the limits of the conditions employed, temperature was the overriding factor.

The following is based on the authors' summary of the results. The difference in environment before spraying did not have any marked effect, but, with the exceptions of nicotine and petroleum oil, all the toxicants used were more insecticidal when the beetles were kept under cool conditions after spraying. Nicotine showed little difference when an inverted filter funnel was used to confine the insects, but was markedly more toxic under cool conditions when they were confined in dishes by means of muslin in order to eliminate any possible fumigant effect. Mortality under warm conditions was higher under filter funnels than under muslin, and, though this may have been due to a fumigant effect, considerable condensation occurred on the walls of the funnels, and the insects probably remained wet for a much longer period, thereby increasing the contact effect. The petroleum oil was more toxic under warm conditions after treatment than under cool ones. The increase in toxicity of chemically active contact poisons under cool conditions appeared to occur whatever the nature of the carrier. In the substances tested, with the exception of nicotine under the special circumstances already noted, the increase in toxicity under cool conditions of after-treatment occurred whatever the volatility of the poison, and was probably due to the physiological condition of the insects at these temperatures and not to their effect on the poison or its carrier. The toxicities of oil, nicotine, lauryl thiocyanate, dinitro-ortho-cresol and DDT in oil under cool conditions throughout were 0·87, 1·23, 1·43, 1·46 and 2·61 times, respectively, those under warm. Two series of experiments were performed with pyrethrins, and in these the toxicities obtained

under warm conditions were 2·67 and 5·01 times those obtained under cool ones; the corresponding figures for pyrethrins activated by terpineol were 7·21 and 6·9.

FINNEY (D. J.). **The Analysis of a factorial Series of Insecticide Tests.**—*Ann. appl. Biol.* **33** no. 2 pp. 160–165, 10 refs. London, 1946.

The following is the author's summary. When a set of insecticidal toxicity tests yields parallel regression lines for the relationship between mortality probit and log dose, the potencies of the materials or conditions under test may be compared purely in terms of log L.D. 50's. The purpose of this paper is to suggest that, when tests have been made with all combinations of several different factors, standard methods for the statistical analysis of factorial experiments may be adapted to the examination of the relative potencies.

Data obtained by Potter & Gillham in a 2^3 factorial experiment on alternative storage conditions for insects before and after spraying and the adjuvant action of terpineol in a pyrethrins spray [see preceding abstract] are used in an example of the computations. Details are given of the test of parallelism of the regression lines, the factorial analysis of the log L.D. 50's, the estimation of the mean effects and interactions and their standard errors, the significance tests, and the preparation of summary tables.

BROADBENT (L.). **Note on the Effect of Wireworms of the Genera *Agriotes* and *Corymbites* on Crop Yields.**—*Ann. appl. Biol.* **33** no. 2 pp. 166–169, 2 figs., 4 refs. London, 1946.

During 1941–43, all crops in the Midlands of England grown on recently ploughed grassland that had been sampled for wireworm populations while still under grass [*R.A.E.*, A **33** 265] were assessed as satisfactory, poor or a failure, and the percentages of crops of 11 different kinds produced on fields with estimated wireworm populations of 0–300,000, 300,000–600,000, 600,000–1,000,000 and over one million per acre that were satisfactory are shown in a table; some of these results have already been noticed [*loc. cit.*]. *Agrioles* was often considered to be the only genus of economic importance in lowland areas, and the effect of controlled numbers on various cereals was investigated in the laboratory. Seeds of winter and spring wheat and oats, spring barley, and rye that had germinated on damp blotting paper were sown in pots and exposed for five weeks to attack by *Agriotes* larvae corresponding in numbers to populations of 375,000, 750,000 and 1,125,000 per acre. The percentage losses due to the lowest and (in brackets) the highest infestations were 20 (53) and 27 (50) for winter wheat and oats, respectively, 32 (63) and 28 (66) for the corresponding spring crops, 18 (63) for rye and 5 (34) for spring barley. Comparison of the observed percentage losses with the percentage of failures recorded for the same crops in the survey showed that the figures for winter wheat and spring oats were comparable and that those for spring barley were higher in the survey than in the experiment, owing to factors other than wireworm damage; the data for rye were inconclusive, since too few fields were surveyed.

At high altitudes, especially in Derbyshire, *Agriotes* was often replaced by *Corymbites* spp. [**32** 434], mainly *C. cupreus*, F., while *Athous* was also fairly common, and the relative injuriousness of these three genera to oats, which is the principal cereal crop of north Derbyshire, was accordingly investigated. Sufficient larvae, at least 5 mm. long, of *Agriotes*, *C. cupreus* and *Athous* were introduced into pots sown with germinated oats to give populations corresponding to 125,000, 375,000, 750,000 and 1,125,000 wireworms per acre, and the numbers of plants destroyed five weeks later were recorded. The percentage

loss due to *Agriotes* varied from 18 for the lowest population to 66 for the highest, and the corresponding figures for *C. cupreus* were 9 and 47. *Athous* appeared to be less injurious, but the data were inconclusive, since few larvae of this genus were available. In another experiment in which nine larvae were introduced into pots containing 25 oat plants five weeks old, the percentages of plants damaged and (in brackets) killed in a week were 48 (36) for *Agriotes* spp., 68 (36) for *C. cupreus* and 8 (0) for *Athous* spp.

JANNONE (G.). **Su una imponente e prolungata migrazione di Lepidotteri attraverso l'Eritrea nel'ottobre 1942.** [A prolonged Mass-migration of Lepidoptera across Eritrea during October 1942.]—*Boll. Soc. ital. Med.* (*Sez. Eritrea*) **4** no. 3 pp. 451–461, 2 refs. Asmara, 1945. (With a Summary in English.)

Large swarms of butterflies were observed migrating in an easterly direction over Asmara, Eritrea, from early October until the beginning of November 1942, activity being at its height towards the end of October. The swarms were found to be composed of upwards of 13 species, chiefly Pierids, Nymphalids and Lycaenids ; Pierids represented 67 per cent. of the individuals and *Vanessa* (*Pyrameis*) *cardui*, L., 6 per cent. The swarms kept fairly close to the ground, travelled during the heat of the day and settled at night. They were thought to have originated beyond the Eritrean highlands, possibly from the western plains of Eritrea, Abyssinia and the Sudan. It thus appears that the butterflies cross the plateau during the dry season and reach the plains bordering the Red Sea, where the rainy season begins in December and ecological conditions become favourable for reproduction and larval development. The migration was said to take place every year at that season, although the author did not observe it at Asmara in 1939 or 1943 ; it may be so insignificant in some years as to pass unperceived. No information was available as to the occurrence of a return migration in the opposite direction ; none seemed to have been observed in Eritrea [but *cf.* next abstract].

JANNONE (G.). **Intensive Development of the Thistle Butterfly,** *Pyrameis cardui* **L. (Lep., Nymphalidae), and an** *Apanteles* **its Parasite, in the Highlands of Eritrea.**—*Int. Bull. Plant Prot.* **20** no. 11–12 pp. 108M–114M. Rome, 1946.

Vanessa (*Pyrameis*) *cardui*, L., sometimes develops intensively on the Eritrean plateau and its slopes, attacking various wild plants and also globe artichoke (*Cynara scolymus*), which is cultivated to a considerable extent in this region, and cardoon (*C. cardunculus*), which is a less important crop. The adults are migratory in Eritrea, in some years and seasons. When they migrate, they usually join swarms of other Lepidoptera [*cf.* preceding abstract]. These are here stated to cross the highlands both from west to east and also in the opposite direction, at distinct periods of the year, depending on the alternation of the rainy seasons. *V. cardui* can, however, develop on the highlands of Eritrea during the heavy rains (July-September) between the migrations. It is not known whether it normally breeds there or whether the population is maintained by the migrants, but it is frequently numerous, and a combination of favourable conditions may lead to a serious outbreak, such as took place in 1945.

In that year severe damage was done, especially in Sembel, a district in south-western Asmara at an altitude of about 7,600 ft., where the artichoke crop was exceptionally heavy. Egg-laying by *V. cardui* occurred between May and October and was extensive during June and most of July, a month or two after the passage of a few flights of butterflies from east to west. From

the second half of August, large numbers of larvae of all ages and pupae were observed, and adults were numerous during September and October throughout Asmara. Pupae formed on 30th and 31st August in the laboratory gave rise to adults on 9th and 10th September. Development continued in the field from the end of June almost to the end of November, during which period one generation completed its development and another began. The numbers of all stages gradually diminished, however, in October and November, the larvae and pupae being destroyed by parasites and the adults migrating to the eastern slopes at the onset of a season of drought and low temperatures in the highlands. In December and January, *V. cardui* was absent from the district ; and the artichoke crop made a good recovery. On the eastern slopes, at altitudes of about 5,525–5,850 ft., the development of the Nymphalid lasted longer, and two generations were completed.

The parasite that attacked the larvae was an unidentified Braconid of the genus *Apanteles*. It was reared in the laboratory from host larvae and from cocoons collected in the field in September. The parasite larvae emerged almost simultaneously from the host larva, remained close to it and spun their cocoons in a mass of webbing. The adults emerged in numbers between 20th September and 10th October. From observations on 16 larvae of *Vanessa*, it was found that 13–67 parasite larvae emerged from one host ; the pupal stage averaged 13·31 days, but was probably longer in the field, where the minimum temperature was below that of the laboratory. Field observations in Sembel indicated that the percentage parasitism was at least 95 and would have been even higher but for the action of hyperparasites.

From mid-August, spraying with 0·5 per cent. lead arsenate was recommended for all wild Carduaceous plants within about 1,000 yds. of the fields. The artichokes themselves were not sprayed, for fear of toxic residues, but larvae and pupae were collected and kept in cages to permit the escape of parasites.

Lupo (V.). **Invasion of *Calocoris norvegicus* (Gml.) in the Communes of the Vesuvius Region.**—*Int. Bull. Plant Prot.* **20** no. 11–12 pp. 105M–108M. Rome, 1946.

In 1934 and 1935, early French beans in some parts of the communes of the Vesuvius region, and particularly at Torre del Greco and Resina, were damaged by the Mirid, *Calocoris norvegicus*, Gmel. In both years, hatching continued from about mid-March to the end of April. The newly hatched nymphs moved to the beans and other plants and fed on the leaves, stems, or, preferably, the buds. At intervals, they ceased feeding and rested in sheltered positions for a time, and they did not appear to feed at night. The nymphal stage lasted 22–30 days, according to the time of hatching and the climatic conditions. The adults fed on the same bean plants, particularly on the floral buds and the young pods, and also on the young seeds in the ears of rye, barley and other graminaceous plants and the floral buds and pods of cabbage and turnip. Mating began in the middle of May, and oviposition occurred during the last ten days of May and in June. The eggs were usually deposited in vine stakes, which in this region are of barked chestnut wood, but sometimes in the cankered wood of various trees. The older split stakes were preferred, and the eggs were usually laid in pairs. The author did not determine whether these eggs overwintered, but considers that there is only one generation a year. The injury to the leaves, flowers and pods of the beans is described. *C. norvegicus* was also observed on fennel (*Foeniculum vulgare* var. *dulce*), which was very attractive to the newly hatched nymphs, and on potato and tomato. Its wild food-plants include poppies (*Papaver rhoeas*) and *Brassica campestris*.

The bugs were collected by shaking the plants into a funnel with a bag attached and destroyed with boiling water or oil emulsion. Nicotine sprays

were not very effective, as the insects are difficult to reach while hiding under the leaves and escape at the slightest disturbance. Pulling up the vine props in winter and immersing them in 10 per cent. mineral oil for about three days, heating them at 70°C. (158°F.), or coating them with tar destroyed the eggs of this and other bugs and gave complete control.

RUSZKOWSKI (J.). **First Colorado Beetle Focus in Poland.**—*Int. Bull. Plant Prot.* **20** no. 11–12 p. 114M. Rome, 1946.

Leptinotarsa decemlineata, Say, was found towards the end of June 1946 in several potato fields in a district of the Kielce region. [It appears probable that this place was one of the two from which it was recorded in a paper recently abstracted (*R.A.E.*, A **36** 254), and that the statement in the abstract that both, instead of one, were in the Department of Poznán was due to an ambiguity in the original.] The area was thoroughly inspected, all beetles found were destroyed and neighbouring fields were treated with insecticidal dusts or sprays.

JANNONE (G.). **Preliminary morphobiological Data on a new Weevil (*Lixus latro* Mrshl.) dangerous to cultivated Crucifers on the Eritrean Highlands.**—*Int. Bull. Plant Prot.* **20** no. 11–12 pp. 115M–121M. Rome, 1946.

The author gives short descriptions of all stages of *Lixus latro*, Mrsh., which was found causing serious injury to cabbage and cauliflower in Eritrea [*cf.* *R.A.E.*, A **34** 14]. The weevil has probably two or even three generations a year, and all stages can be found in every month, but the adults, which are long-lived, are present in greatest numbers from early January until the middle of October. Most of them originate from plants left for seed. They feed on cabbages of the new crops by removing the green cortex of the stalk or the epidermis of the foliar rib or that of the leaves with part of the mesophyll. Pairing and oviposition occur in July–August, and the eggs are laid singly in small cavities made in the stalks of seedlings or old plants ; stems of old or well-developed plants may contain 15–25 eggs deposited at various times by different females. The larvae excavate galleries in the intracortical zone and afterwards in the medulla, expelling waste matter through openings in the stalk, and pupate in special niches. The adults remain in these for 2–3 days or more, until their cuticle has hardened. The larval stage lasted about 2½–3 months in October–January, but was shorter in February–June, and the pupal stage varied from 13–14 to 24–25 days according to the temperature. Eggs and newly hatched larvae were present throughout October and November in 1944 and 1945, and larvae that were fully grown or in an advanced stage of development were found from the end of December onwards, though small larvae were still present in March and April.

In the Eritrean highlands, *L. latro* attacked cabbage, cauliflower and sometimes radishes, infesting up to 66 per cent. of the plants. In October 1945, it was found that many plants died rapidly owing to root rot ; this was probably caused by a fungus, the spread of which would be facilitated by the continual movement of the weevils from plant to plant during the feeding and oviposition periods. No parasite of *L. latro* was discovered, but flaccid and blackened larvae found in the stalks of old plants with the medulla reduced to pulp had probably died through the action of pathogenic agents that occurred in the unhealthy environment created by their own activity. To control the weevil, only seedlings showing no sign of infestation should be planted, developing

plants, those left for seed production and the stems of harvested plants should be examined for infestation; and all infested plants should be pulled up and destroyed immediately. Two or three rows of stalks with a few leaves should be left along the borders of the fields to attract ovipositing females, and destroyed when carrying a heavy infestation. These plants could also be sprayed with lead arsenate to poison the adults that come to feed and oviposit.

RUSZKOWSKI (J.). **Crop Pests accidentally introduced into Poland during the War.**—*Int. Bull. Plant Prot.* **20** no. 11–12 pp. 121M–122M. Rome, 1946.

Bruchus obtectus, Say, was found in the Cracow region of Poland in 1945, having probably been introduced in imported haricot beans in 1944, but was eliminated. *Spermophagus subfasciatus*, Boh., has been found in considerable numbers in imported haricot beans but is unlikely to survive the cold Polish winters.

DEL CAÑIZO GÓMEZ (J.). **Hydrocyanic Acid Fumigation against the Olive Thrips in Spain.**—*Int. Bull. Plant Prot.* **20** no. 11–12 pp. 126M–127M. Rome, 1946.

Notes are given on the organisation and cost of an intensive campaign for the control of *Liothrips oleae*, Costa, on olive in which compulsory tent fumigation with hydrocyanic acid gas was carried out on about a million trees in the province of Jaén, Spain, between 17th November 1945 and the end of March 1946. The work was to be continued.

DAVATCHI (A.). *Saissetia oleae*, **Bernard (Homoptera-Coccidae) en Iran.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. *1–7*, 2 figs., 3 refs. Teheran, 1946. (With a Summary in French, pp. 1–2.)

Saissetia oleae, Bern., which had not previously been recorded from Persia, was found on a small number of plants of oleander (*Nerium oleander*) at the Agricultural Station at Ramsar, on the Caspian coast, in April 1946. The reproductive females occurred on the leaves mainly round the main vein on the lower surface, and hatching began on 5th May in samples taken to Teheran. Since the establishment of the Coccid would be a serious menace to *Citrus* and olive, the most important fruit crops in the region, the infested oleanders were pulled up and burnt, all plants within a radius of about 11 yards were sprayed with oil emulsion, and careful watch was kept for further infestation in the garden.

Chilocorus bipustulatus, L., which is abundant in the north of Persia and is generally predacious on *Chrysomphalus dictyospermi*, Morg., was found to attack *S. oleae*. No insect parasites were found, but some females were heavily infested by *Cephalosporium lecani*, a fungus common on Lecaniine Coccids in northern Persia.

KIRIUKHIN (G.). **Les insectes nuisibles au pistacier en Iran.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. *8–24*, 12 figs., 4 refs. Teheran, 1946. (With a Summary in French, pp. 2–4.)

In southern Persia, there are still many wild pistachio plants (*Pistacia mutica* and *P. khindjuk*) and they are infested by a number of injurious insects, nearly

all of which are also found on cultivated pistachio (*P. vera*). *Idiocerus ståli*, Fieb., is the most injurious in all the pistachio-growing regions of Persia. This Jassid produces abundant honeydew, which impedes the development of the fruits, and 70–90 per cent. of the crop is sometimes lost. Spraying with nicotine gives satisfactory control, but an emulsion containing 0·1 per cent. DDT was much more effective and dusts of 5 and 10 per cent. DDT also gave good results. A species of *Psylla*, probably undescribed, occurs on wild and cultivated pistachio throughout all the southern regions, but its numbers are limited by an Encyrtid parasite of the genus *Prionomitus*. The trees are also attacked by *Capnodis cariosa*, Pall., *C. tenebricosa*, Hbst., *C. parumstriata*, Ballion, and *C. carbonaria*, Klug. The last is the most injurious; the larvae feed on the cambium in the region of the collar, and four or five can kill a tree 25–30 years old. The larvae of *Agrilus* sp. bore galleries in the peduncles and larger branches of the clusters. *Hylesinus* (*Chaetoptelius*) *vestitus*, M. & R., causes very important damage to cultivated pistachio. The adult appears in June and burrows to a depth of about half an inch at the junction of the petiole with the young branch, destroying the bud and causing drying out of the infested branch. The eggs are laid in July under the bark of the branches, particularly on weak trees. The larvae make galleries leading from the parent burrow and pupate in the following spring. *Megastigmus pistaciae*, Wlk., deposits its eggs in the young fruits in spring, and the larvae feed on the kernels and remain inside the fruits until the following spring, when they pupate in them and transform to adults.

The other insects recorded on pistachios are Aphids, which cause no appreciable damage, Coccids and Lepidoptera. The Coccids comprise *Pulvinaria pistaciae*, Bodenh., which is found practically everywhere on wild and cultivated trees but causes noticeable injury only in the northern plantations; *Lepidosaphes pistaciae*, Arkh., which is particularly abundant on wild pistachio in Kerman and Shiraz; *Leucaspis pistaciae*, Lind., which occurs on the trunks and branches, but is controlled by parasites; *Melanaspis* (*Aonidiella*) *inopinata*, Leon., which is here recorded for the first time in Persia, on wild pistachio in parts of Kerman and Fars, as well as on cultivated pistachio and pear; and *Eulecanium rugulosum*, Arkh., which is found on fig (*Ficus carica*) near Shiraz and on *P. vera* to the south of it. The Lepidoptera are *Thaumetopoea processionea*, L., which attacks the leaves in spring, particularly in the plantations of Kazvin, Damghan and Kerman, *Euproctis* (*Porthesia*) *kargalike*, Moore, which occurs on cultivated plants in plantations near pistachio forests, *Nepticula promissa*, Stgr., and *Leucoptera* (*Cemiostoma*) *scitella*, Zell.

Esfandiari (E.). *Fusarium juruanum* **P. Henn. sur la cochenille rouge** (*Chrysomphalus dictyospermi* **Morg.) au nord de l'Iran.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. *25–27*, 1 fig. Teheran, 1946. (With a Summary in French, p. 5.)

Chrysomphalus dictyospermi, Morg., was introduced into Persia about 1931 and has become injurious and widespread in the north, where it attacks *Citrus* and many other plants, including *Buxus sempervirens*, *Laurus nobilis*, loquat (*Eriobotrya japonica*), tea, camphor [*Cinnamomum camphora*], *Camellia*, olive, rose, *Magnolia* and willow. In November 1944, *Fusarium juruanum* was found infecting almost 90 per cent. of the scales in very humid regions of the province of Gilan. The fungus attacked both living and dead insects, but does not offer a practical means of control, since the most important *Citrus*-growing regions in northern Persia are the provinces of Mazandaran and Tonekabon, where the humidity would be too low for it.

Kaussari (M.). **Insectes nuisibles aux aurantiacées, sur les côtes de la mer Caspienne.** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. *32–38*, 1 fig., 2 refs. Teheran, 1946. (With a Summary in French, pp. 8–9.)

Of the Coccids that are injurious to *Citrus* in northern Persia, *Chrysomphalus dictyospermi*, Morg., was introduced about 1931 from the Mediterranean on young orange plants and spread rapidly over the whole of the Caspian coast. The measures used against it are fumigation with hydrocyanic acid gas or spraying with oil emulsions. *Aonidiella aurantii*, Mask., was introduced in 1935 on plants from Palestine. Its spread was prevented by quarantine measures, but an isolated infestation was observed on orange at Ramsar in 1945. *Parlatoria pergandei*, Comst., has recently been found in an orange grove at Sari. *P. zizyphus*, Lucas, is abundant along the eastern part of the Caspian coast, particularly at Babolsar and Gorgan. *Lepidosaphes gloveri*, Pack., occurs in small numbers on orange along the coast, but is of little economic importance; *L. beckii*, Newm., has a very limited distribution in Persia, but sometimes causes severe damage to orange at Ramsar. *Coccus hesperidum*, L., is common on *Citrus* in the north, and is injurious chiefly because of the abundant sooty mould that almost always accompanies it. *C. pseudomagnoliarum*, Kuw., has recently been observed on orange in the region of Gorgan, but its economic importance is not known. *Ceroplastes sinensis*, Del G., was introduced in 1935 with plants from Palestine, but quarantine measures caused its complete disappearance. *Pulvinaria floccifera*, Westw., occurs throughout the north from Pehlevi to Babol, but rarely causes appreciable damage. *Icerya purchasi*, Mask., imported on young plants from Italy, was first observed in 1928 near Babol and had invaded large areas of orange plantations in this region by 1931 [*R.A.E.*, A **20** 266]. Colonies of *Rodolia* (*Novius*) *cardinalis*, Muls., from France were distributed in the infested plantations and gave excellent control. The Coccinellid is bred in the insectary for distribution to newly infested regions.

Evestropof (E.) & Eghlidi (S.). *Anisoplia* **spp. (Coleoptera-Scarabeidae).** [*In Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. *46–47*. Teheran, 1946. (With a Summary in French, p. 11.)

In the province of Kurdistan, in western Persia, species of *Anisoplia* have become increasingly injurious during the last few years. First- and second-year larvae are particularly abundant in cool or slightly humid soils. The adults begin to emerge towards the end of May, feed on wild grasses for a time and then attack cereal crops. *A. leucaspis*, Lap., *A. segetum*, Hbst., *A. agricola*, Poda, and *A. austriaca*, Hbst., have been found together in wheat fields, where they feed on the seeds. Pairing and oviposition take place during the heat of the day, each female laying about 50 eggs at a depth of 4–8 ins. in cool light soils. Cultural control methods, such as ploughing to a depth of 8–10 ins. immediately after oviposition, the choice of early varieties of wheat and hand collection in heavily infested fields, reduce the damage considerably.

Evestropof (E.). **Note sur quelques Orthoptères de l'Iran.** [*In French and Persian.*]—*Ent. & Phytopath. appl.* no. 1 pp. 12–14. Teheran, 1946.

A list is given of some 65 species of Orthoptera collected in southern Persia, including 18 that were injurious to crops. These are the Acridids, *Dociostaurus maroccanus*, Thnb., *D. kraussi*, Ingen., *Ramburiella turcomana*, F. W., *Oedaleus decorus*, Germ., *Pyrgodera armata*, F. W., *Chrotogonus turanicus*, Kuthy, *Schistocerca gregaria*, Forsk., *Calliptamus italicus*, L., *C. turanicus*, Tarb.,

Thisoecetrus littoralis, Ramb., and *Thisoecetrinus pterostichus*, F. W., the Tettigoniids, *Tettigonia viridissima*, L., *T. caudata*, Charp., *Decticus verrucivorus*, L., and *D. albifrons*, F., and the Gryllids, *Gryllulus* (*Gryllus*) *desertus*, Pall., *Gryllotalpa gryllotalpa*, L., and *G. unispina*, Sauss. The Acridids attack all the important crops such as cereals, cotton and beet, the Tettigoniids are more or less confined to cereals and the Gryllids are particularly injurious to vegetables. Suggestions for control by the usual methods are made.

HARGREAVES (H.). **List of recorded Cotton Insects of the World.**—[1+]50 pp., 38 refs. London, Commonw. Inst. Ent., 1948. Price 5*s*.

A list is given of the insects and mites (arranged in systematic order) that have been recorded on cotton in the literature abstracted in this *Review* (vols. 1–34) and in unpublished lists of the Empire Cotton Growing Corporation. It records the part of the plant attacked by each species and the countries in which it occurs on cotton. Indexes to the families and genera and to the countries are included.

MUNRO (J. A.). **DDT as an Insecticide against the Onion Maggot.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **9** no. 3 pp. 81–82. Fargo, N. Dak., 1947.

Hylemyia antiqua, Mg., was injurious to onions in the Fargo area of North Dakota in 1945, particularly in small plantings, though some varieties were less infested than others. In one garden in which infestation of shallots was apparently 100 per cent., a suspension of 1 oz. 25 per cent. DDT per U.S. gal. water was applied to the base of the plants as a coarse stream as soon as the maggots were observed. Only enough spray was used to damp the soil. Within four days, the damage to the treated plants had been arrested, whereas untreated ones showed rapid deterioration, and three weeks after treatment 90 per cent. of the treated plants had survived as compared with 12 per cent. of untreated ones; the treated plants averaged 16 ins. in height, and the untreated survivors only 11¼ ins.

KNOWLTON (G. F.). **A new Maple Aphid from Utah and some Aphid Records.**—*J. Kans. ent. Soc.* **20** no. 1 pp. 24–26. Manhattan, Kans., 1947.

Periphyllus palmerae, sp. n., is described from alate viviparae and alate males collected in October 1941, on the leaves of soft maple [*Acer glabrum*]. Other Aphids recorded from Utah include *Aphis hederae*, Kalt., which damaged English ivy [*Hedera helix*] in June 1946, *A. ribi-gillettei*, Kn. & All., which injured the apical leaves of black currant in June 1941 and July 1945, and *A. heraclella*, Davis, which damaged celery in August 1943 and June and August 1946; Aphid-transmitted western celery mosaic [*Marmor umbelliferarum* of Holmes] was very destructive in Utah in the latter year.

PAPERS NOTICED BY TITLE ONLY.

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The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Director, Commonwealth Institute of Entomology, 41, Queen's Gate, London, S.W.7.

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